

Active travel and mid-life

Evidence on attitudes
and on the role of the
built environment

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In partnership with:

About us

Centre for Ageing Better

The UK's population is undergoing a massive age shift. In less than 20 years, one in four people will be over 65.

The fact that many of us are living longer is a great achievement. But unless radical action is taken by government, business and others in society, millions of us risk missing out on enjoying those extra years.

At the Centre for Ageing Better we want everyone to enjoy later life. We create change in policy and practice informed by evidence and work with partners across England to improve employment, housing, health and communities.

We are a charitable foundation, funded by The National Lottery Community Fund, and part of the government's What Works Network.

Sustrans

Sustrans vision is a society where the way we travel creates healthier places and happier lives for everyone. Our mission is to make it easier for people to walk and cycle.

Contents

About us	2
Glossary of key terms	4
Part 1. Introduction to the reviews	6
Part 2. Executive Summary	8
Part 3. Attitudes to active travel	15
Appendix A. Details of included studies	54
Part 4. Role of the built environment	56
Conclusion	91
Appendix B. Details of included studies	93
Appendix C. Included studies by key themes	96
References	98

Glossary of key terms

Accessibility: In transport planning, accessibility refers to a measure of the ease of reaching (and interacting with) destinations or activities distributed in space, e.g. around a city or country.

Active travel: Making journeys by physically active means, primarily walking or cycling.

Correlation: A mutual relationship or connection between two or more things.

Correlates study: A type of non-experimental research method in which a researcher measures two variables to understand and assess the statistical relationship between them with no influence from any extraneous variable.

Cross-sectional study: A type of observational study that analyses data from a population, or a representative subset, at a specific point in time.

Housing density: The quantity of people or buildings in an area.

Intersection density: An indicator of street network connectivity, which supports pedestrian activity by allowing more direct walking routes.

Intervention studies: Studies specifically designed to evaluate direct impacts of treatment or preventive measures on disease or other outcomes.

Meta-analysis: Statistical analysis that combines the results of multiple scientific studies.

Mid-life: Those aged between 50 and 70.

Mixed land use (diversity): A mixture of compatible land uses including public amenities, shops, housing and utilities together at various scales and intensities.

Natural experiment: A natural experiment is an empirical study in which individuals (or clusters of individuals) are exposed to the experimental and control conditions that are determined by nature or by other factors outside the control of the investigators.

Outcomes: An outcome measure, endpoint, effect measure or measure of effect is a measure within medical practice or research (primarily clinical trials) which is used to assess the effect, both positive and negative, of an intervention or treatment.

Odds ratio: A measure of association between exposure and outcome. It represents the odds that an outcome will occur given a particular exposure, compared to the odds of the outcome occurring in the absence of that exposure.

Prospective study: A type of cohort study, or group study, where participants are enrolled into the study before they develop the disease or outcome in question.

Quantitative: Measuring the quantity of something rather than its quality.

Qualitative: Measuring the quality of something rather than its quantity.

Residential density: The average number of families living on one acre of land in a given area.

Systematic review: A review of literature that uses repeatable analytical methods to collect and analyse the findings.

Statistical significance: A measure that helps quantify whether a result is likely due to chance or to some factor of interest.

Total walking: The total amount of walking combining recreational walking and walking for transport.

Transport walking: Walking with a main purpose of travelling to a destination such as work, an educational institution, for healthcare or for shopping.

Walkability: The extent to which characteristics of the built environment and land use may or may not be conducive to residents in the area walking for either leisure, exercise or recreation, to access services, or to travel such as to work, shops and local facilities.

Part 1.

Introduction to the reviews

Regular physical activity is key to a healthy lifestyle. Chief Medical Officers across the UK¹ and the World Health Organization² make strong and regular recommendations for regular physical activity of at least moderate intensity for people of all ages. The evidence of the health benefits is strong: regular physical activity is proven to help prevent and manage non-communicable diseases such as heart disease, stroke, diabetes and several cancers. It also helps prevent hypertension, maintain healthy body weight and can improve mental health, quality of life and well-being.²

Active travel – walking and cycling for transport such as to school, work, and in meeting other local travel needs – has been identified as one of the easiest ways to build routine physical activity into daily life. Despite the numerous benefits, over 60% of all trips in the UK are made by car – even when trips are of a distance suitable for walking or cycling^a. There is, therefore, enormous potential for change.

For most people in most countries, physical activity declines from adolescence across the life-course.³ Walking for transport also declines with age.⁴ There is no reason why participation in active travel should decline with age, though this is seen even in European countries with higher rates of active travel, including at older ages, than in the UK. In Germany, 12% of journeys made by people over 65 are on a bike, and in the Netherlands people over 65 make 24% of their trips by bike. In Germany, 12% of journeys made by people over 65 are on a bike, and in the Netherlands people over 65 make 24% of their trips by bike. This compares to less than 1% in the UK. In Germany, the bike share of trips rises steadily from 7% among 18-24-year-olds to 12% for those 65 and older. The bike share of trips declines with age in the Netherlands, from 36% among 18-24-year-olds but at age 65+, 24% of trips are still by bike. In the UK only around 1% of trips for people of all ages are by bike.⁵

a Note that when we refer to levels of walking, cycling or active travel in a general sense throughout this review, as in “higher housing density was associated with greater levels of walking” level refers to the proportion of all journeys undertaken by means of walking, cycling or active travel respectively.

This implies that the problem is not that older people cannot cycle but that the current cycle infrastructure and social norms in the UK do not encourage them to do so. There is a strong evidence base from reviews highlighting the central role of infrastructure in making not only cycling but also walking safe.⁵

The Centre for Ageing Better wants to understand how people in mid-life (aged from 50 to 70) can be supported to take up active travel – or to maintain or increase the amount of active travel they do – as a first preference for everyday journeys.^a They commissioned **Sustrans** to undertake reviews of the evidence available from existing studies in two key areas for people aged 50 to 70:

- Attitudes to active travel
- The role of the built environment in influencing active travel

It is important to note that there are contrasting bodies of literature for each of these key areas. There is very little literature on attitudes to active travel (especially for adults aged 50-70), and that which does exist is mainly from small-scale qualitative studies. In contrast, there is a very large, substantial and methodologically strong body of literature on the role of the built environment. For this reason these two reviews were conducted as separate exercises, each taking the form of a literature search and review of the evidence.

This report sets out the findings and conclusions of each of the reviews separately, including the different review methods used. The executive summary to this report sets out the main findings of each review and considers what the evidence from both reviews tells us as a whole about active travel and mid-life.

The reviews were led by Professor Adrian Davis (Adrian Davis Associated/Edinburgh Napier University) and Dr Nick Cavill (Cavill Associated/University of Bristol), supported by Dr Andy Cope and David Corner of Sustrans. The review team were able to call on the advice and expertise of an advisory group consisting of the following experts on active travel:

- Prof Harry Rutter, University of Bath
- Emeritus Professor Miles Tight, University of Birmingham
- Dr Paul Kelly, University of Edinburgh

These reviews are the first stage in exploring the issue of active travel in people aged 50-70. The subsequent stage of the project will include detailed qualitative research among people aged 50-70 using semi-structured interviews. One of the main objectives of these reviews was to provide a foundation for the subsequent primary research by exploring the main issues from the literature and identifying important gaps.

Part 2.

Executive Summary

The evidence on active travel in mid-life

With a view to ensuring that everyone can enjoy a good later life, the Centre for Ageing Better focuses on people aged from 50 to 70, especially those most at risk of missing out on a good later life. With a view to improving levels of physical activity in people in this age group, Ageing Better commissioned Sustrans to undertake two reviews of the evidence on active travel among people aged 50 to 70 exploring:

- Attitudes to active travel
- The role of the built environment in influencing active travel

However, this age cohort is not one that has been researched in the past – including in the transport literature – and it is not therefore surprising that we found few studies that focus on this age range or that cover this age range exactly.

It is important to note that the two evidence bases are both conceptually and methodologically unique. As noted above, the attitudes review is based on a very small number of small-scale and largely qualitative research projects. Within this, we could only use findings from the small number of research participants whom we could definitely identify as being aged 50-70. This puts significant limitations on the extent to which these findings can be extrapolated to the mid-life population in general.

In contrast, the body of literature on the influence of the environment is large, substantial and methodologically sound. It allows strong conclusions to be made about the influence of the environment on active travel. However, it relates to adults of all ages, and so direct application to adults in mid-life is based on the assumption that an environment that has been shown to be good for active travel in all adults is also good for adults in mid-life.

As is common with much transport research, there is little in this evidence base on the differential attitudes of, or differential impacts of the environment on, specific population groups including Black, Asian, other minority ethnic communities^b and disabled people. Active travel includes wheelchair use, but the reviews found no

^b Referred to hereafter as minority ethnic groups and including all ethnic groups except the majority White group.

evidence on this topic. We also found no analysis looking at attitudes to active travel segmented by socio-economic status. Rural/urban differences were explored in some studies, but no study covered them specifically.

Evidence on attitudes to active travel and mid-life

We found that the most important motivator for active travel in people in mid-life was the wide range of health benefits. Research participants broadly recognised that active travel is ‘good for them’ and talked of the feelings of health and vitality from getting out and about. These health benefits were usually viewed in very general terms: ‘getting exercise’ or ‘getting the blood rushing’ or ‘helping the weight’.

It might have been hypothesised that people in mid-life are more likely than younger people to deliberately take up physical activity in order to reduce their risk of specific conditions (such as obesity or heart disease). However, only a small number of references to a preventive approach were found, including strengthening legs and knees and reducing the impact of existing conditions (including knee operations and Parkinson’s disease in one case). The prevalent attitude among people in mid-life seemed to be a generalised appreciation of the health benefits, notably feelings of vitality, and they were almost as likely to refer to the mental health benefits (and stress reduction) of active travel.

The enjoyment of being outside in fresh air was also an extremely strong motivator – for both cycling and walking. This appreciation of the outdoors – feeling free and able to wander or ride wherever – was also closely linked to feelings of independence thanks to the act of getting out and about. This was very strongly felt among participants in the studies who were committed cyclists, but was also quoted by walkers. There were virtually no references to the environmental benefits of cycling and walking within our review data. It appears that enjoying the outdoor environment is much more of a motivator for people in mid-life rather than protecting the environment. There were few or no references to ‘saving the planet’ or ‘reducing carbon’, and more to enjoying being outside and enjoying the local environment. This includes a feeling of being part of the local community – by meeting and bumping into people – as much as being in green space or nature.

Walking is likely to be part of most able-bodied people’s lived experiences, yet it is so commonplace and taken for granted that reporting it is often not considered. The picture is clearer for cycling as it is a minority activity undertaken mainly by people identifying as keen cyclists. Those cycling in mid-life largely did so despite the barriers and had often adapted a resilience through tactics such as finding relatively safe and more pleasant routes away from streets with heavy traffic.

It could be argued that people in mid-life are likely to be at least considering retirement, if not actively preparing for it. However, although retirement did come up in some studies it was not as dominant a theme as might be expected. Many participants referred to active travel having a more prominent role in their younger years, either through necessity (not being able to afford a car), youth (having more energy and fitness to walk or cycle) or societal trends (cycling and walking being more common and perceived as safer). Some of the people in mid-life interviewed in these studies referred to periods in their lives when changes in family, employment and housing led to changes in travel patterns – moving closer to work, for example. However, this age group tends to be quite stable when it comes to travel habits so opportunities for changes due to life stage are rare.

The exceptions to this stability are study participants who made a deliberate choice to become more active on retirement. Some referred to walking more often, but more people had bought (or been bought) a bike on approaching retirement. This is perhaps due to the conscious act of taking up cycling being a much more tangible behaviour change than simply walking more. In particular, it was notable that even in studies that claimed to report on walking and cycling much of the focus (including quotes from participants) were from people in mid-life using bicycles. Behaviour change among bicycle users is also made easier by the increasing trend towards e-bikes, which help to reduce barriers to hills and distance and hence give greater freedom to travel and over greater distances.

The following table sets out the key motivators for and barriers to active travel among people in mid-life as synthesised from the review.

Active travel – general	
Motivators and enablers	Barriers
<ul style="list-style-type: none"> - Health benefits of physical activity - Mental health benefits (relaxation and stress reduction) - Enjoyment of the outdoors – enjoying fresh air, being in the community and seeing what’s going on - Feeling independent and in control - Preparing for an active retirement - Changes in personal circumstances, such as moving home or changes in employment 	<ul style="list-style-type: none"> - Distances too great in rural areas - Lack of motivation/lack of priority - Weather - Personal safety or feeling unsafe - Lack of an active travel habit - Declining health or disability

In addition, the following cycling-specific motivators, enablers and barriers were identified:

Active travel – cycling-specific	
Motivators and enablers	Barriers
<ul style="list-style-type: none"> - Having cycled in earlier life - Feeling an identity as a cyclist and part of the cycling community - Understanding and valuing the tangible benefits of cycling, such as predictable journey times and no traffic jams - Developing resilience and coping strategies to overcome unsupportive cycling environments 	<ul style="list-style-type: none"> - Fear of motorised traffic - Lack of confidence - Poor cycle infrastructure - Prevailing car culture, including poor driver behaviour

Evidence of the role of the built environment on active travel and mid-life

Good quality evidence from numerous systematic reviews that the environment has a significant role in encouraging or discouraging active travel was found. This evidence comes from intervention studies and natural experiments that have seen increases in active travel when aspects of the built environment were improved. This review did not set out to quantify the specific impact of the environment compared to other aspects (such as behavioural interventions), but environmental interventions alone have been sufficient to lead to changes with public health benefits. Combining environmental interventions with behaviour change approaches are likely to lead to even greater impacts.

Places where active travel is high are likely to have the following components:

- **Supportive infrastructure:** a continuous route to travel along – whether on foot or by bicycle – with low perceived and real danger posed by motorised traffic and other risks and obstructions. For cycling, this will often require physical separation from motorised traffic, especially in the form of new, continuous and separate cycle routes. These will often require road space reallocation so that cycle infrastructure becomes a normal part of the traffic landscape rather than the exception.

- **Walking and cycling-friendly connected street networks:** environments that emphasise active travel and ‘walkability’. These ensure that when interacting with motorised traffic, active travel users continue to be at minimal risk of injury. This means ease of crossings, whether at junctions or along street sections, which are made safer, improving access to destinations.
- **High density and mixed land uses:** locating shops, housing and workplaces close together so that journey distances are short. High densities of populations mean services can support local populations, and people can interact without long journeys.

Where evidence of any age-related effect of the environment was found, it was supportive of an assumption that active environments support active travel among people in mid-life. A significant part of the literature reviewed referred to older people (those of 65 or 70 years and over) and found positive impacts of an active environment on walking or cycling. There is therefore no reason to believe that the positive impact of the environment on active travel does not extend to people aged 50-70. However, the evidence would undoubtedly be strengthened by studies addressing this age group specifically.

Policy recommendations to facilitate active travel among people in mid-life arising from the evidence of the reviews

The evidence from the reviews has helped Ageing Better to formulate 13 key policy recommendations that will help to facilitate active travel amongst people in mid-life:

- Build infrastructure that supports walking and cycling. This includes pavements, cycle lanes separated from motorised traffic, cycle parking, pedestrian/cyclist bridges and traffic calming measures. Prioritise maintenance to ensure quality.
- Consider the different needs of pedestrians and cycle users and address them in urban design.
- Invest in cycling at the town level, making system-level changes rather than building piecemeal cycle lanes.
- Emphasise ‘walkability’. Invest in street networks that are connected and maximise accessibility to key local destinations.
- Emphasise safety: crossing roads with confidence requires better and more crossing facilities to increase connectivity, accessibility and convenience.
- Design and re-design neighbourhood street networks to enable short trips by bicycle as part of a programme to dovetail with ‘whole town/city’ networks.

- Ensure street network and connectivity components start from the doorstep – direct routes through neighbourhoods are critical for both pedestrians and cycle users.
- Increase accessibility and convenience within street networks so that they give pedestrians advantages over car use for short trips.
- Make town and village centres more attractive places to walk and cycle by aesthetic improvements such as seating, planters or small community parks.
- Take a longer-term view – disinvesting in towns and villages and encouraging out-of-town shopping and employment centres will increase car traffic and reduce active travel. An aim to increase population and housing density will help to ensure travel distances are short, supported by mixed land use so that local shops, services and facilities are viable.
- Policymakers should use the guidance from the Department for Transport and walking and cycling groups on the specific, detailed aspects of micro-level environmental change to promote walking and cycling, for example, detailed guidance on cycle lane design.
- Recognise that walking and cycling are allied with public transport. Every bus trip begins and ends with a walk. The availability and accessibility of public transport is reported as inducing walking (and to a lesser extent, cycling).
- Ensure ease of access to public transport through street networks designed with direct access to frequent stops and penetration of bus services into neighbourhoods that can increase both active travel and public transport use.

What the evidence from both reviews tells us as a whole about active travel and mid-life

We found no conflicts in the findings between our two separate reviews. And although they are both conceptually and methodologically distinct, we found that the attitudes of people in mid-life and the built environment were often inextricably linked.

- In our attitudes review, one of the key ‘addressable’ barriers to people in mid-life taking up active travel for the first time, or engaging in more active travel, is perceptions of a lack of safety. Our built environment review found strong evidence that active travel was higher where supportive infrastructure allowed travel along continuous routes, whether on foot or by bicycle, with low perceived or real danger posed by motorised traffic or other risks and obstructions.

- In our attitudes review, a key potential barrier for people in mid-life to travel actively was distance to be travelled. Our built environment review demonstrated there was very strong and consistent positive association between neighbourhood walkability (where services could be accessed locally and close to people’s homes) and older adults walking for transport.
- Our attitudes review showed that a key barrier to people in mid-life cycling more was the lack of cycling infrastructure, such as segregated cycle paths, and evidence from our reviews of built environment intervention studies clearly demonstrated that creating infrastructure to support cycling – predominantly building new bike paths or bike lanes – leads to increases in cycling for transport.
- The aesthetics of an area have been identified as an attribute of an environment associated with likelihood of using walking and cycling for travel and this could be related to the enabler, identified in the attitudes review, of enjoyment of the outdoors and being in the community.

The need for primary research and new approaches to evidence on active travel and mid-life

The lack of clear, specific evidence relating to active travel and mid-life that emerges from these reviews provides strong justification for conducting further primary research among people aged 50-70 in the UK, as planned by the Centre for Ageing Better.

Research which focuses on ‘middle-age’ and ‘pre-retirement’ cohorts would be better placed to address questions specific to those age groups rather than being combined with ‘older people’ age groupings, not least given the potential changes in active travel and travel generally when people retire.

There is also a need for more studies that focus on:

- The influence of the environment on walking and cycling in semi-urban or rural areas, rather than urban settings.
- The differential impacts of the environment on specific population groups including Black, Asian and other minority ethnic communities and disabled people, including wheelchair users.

There is a need for more intervention research, notably natural experiments. This would strengthen the case that active travel can be increased through environmental change. The ideal natural experiment would combine environmental change with a behaviour change element.

Part 3.

Attitudes to active travel

This part of the report sets out the purpose and methods of the first evidence review on attitudes to active travel among those in mid-life. It then separately identifies the detailed findings from the quantitative and qualitative studies before identifying key themes and drawing conclusions including on the implications for future research in this area.

Purpose and methods

The review set out to answer one main research question:

- What are the psychological, social and cultural factors that are (or might be) antecedents of active travel in people aged 50-70 in the United Kingdom? These include issues such as attitudes, habits, barriers, motivations, experiences, preferences, trigger points and life-stages.

Further issues we wished to explore among people aged 50-70 in the UK included the following:

- What motivates them to undertake active travel and what prevents them?
- What would motivate and/or enable them to use or trial new forms of active travel such as e-bikes?
- How do behaviours and preferences differ for working and non-working people?
- What is the link between unmet transport needs and active travel?
- How do people's active travel habits change over the life course and why?
- Are there trigger points that precipitate starting or stopping active travel and how are they different for different people?
- Do preferences, habits and motivations differ for different age groups? Is the biggest variation by age or by other factors within the same age cohort?

Review inclusion criteria

The definitions and criteria used to cover the types of evidence that were to be included in the review were as follows:

Definition of ‘Active Travel’: For the purpose of this review, ‘Active Travel’ was defined as primarily walking and cycling, though some other minor modes of travel that include physical activity such as scooter-riding and wheelchair use (wheeling) were also included. These must have been for the purpose of transport – getting from place to place – and not for recreation, fitness or leisure.

Intensity of activity: All intensities of physical activity were included if they involved transport, so walking/cycling could be done at any pace.

People covered: Adults aged 50-70 in the United Kingdom. Where literature covered wider age ranges, data from people aged 50-70 were extracted where possible.

Study design: Study designs covered were primary qualitative studies and reviews of qualitative studies of attitudes to active travel. Quantitative studies of attitudes to active travel were also included to provide context.

Publication status: Studies included had to be published either in academic or ‘grey’ literature (i.e. reports or studies published other than in a formal scientific journal). ‘Published’ means produced at least as a PDF document on a reputable website and conducted using generally acceptable methods and analysis.

Review methods

Searching

For peer-reviewed literature, health, social science, age and transport-related databases were searched for studies in English language journals published between 2000 and 2020. Databases included: MEDLINE, CINAHL Plus, PsychInfo, Scopus, SportsDiscus, Scholar Google and TRID (Transport Research International Documentation).

We used search terms that included a combination of key words related to qualitative research methods, active travel and mid-life. The searches were supplemented with hand searches of the Journal of Transport and Health, the publications section of the Centre for Diet and Activity Research (CEDAR) at the University of Cambridge and through contact with authors. We also checked references in previous studies that provided context (e.g. PistoL, Cummins, 2018⁶).

Additionally, we convened an advisory group of leading researchers in the field of active travel, transport and physical activity that checked the identified studies for completeness.

For grey literature, search began using Google. A variety of search terms was included and the first ten pages of every search result were scrutinised. Additional searches were conducted with Google Scholar. We also conducted purposive searches of government and government agency websites, scoured our own files, requested studies from the advisory group and other academic colleagues and searched reference lists of included papers.

Screening

We screened records by title and abstract to identify UK studies published in peer-reviewed journals. We retrieved the full texts of journal papers which the two principal authors then screened to determine eligibility for inclusion. Any discrepancies were discussed and agreed by consensus. We also screened grey literature using contents pages rather than abstracts.

Eligible studies (a) included people aged >50 resident in the UK and (b) presented data on 50-70 year olds' experiences of utility active travel (walking, cycling and/or wheeling). Where data from wider age groups was presented, the study was included if data from people in the 50-70 year age group could be specifically identified. Quantitative studies were included, as were mixed-method studies where the qualitative component was reported separately.

Data extraction and quality appraisal

Both reviewers undertook data extraction and cross-checked each other using a standardised data extraction form covering aims, study details, study design, analytical methods and key results. Study quality was assessed using a standard framework that covers a range of domains including methods, data analysis and ethics. Both reviewers undertook quality appraisal and discussed any issues and agreed amendments where appropriate.

Results of literature searches and data extraction

We found 2,009 references from peer-reviewed and grey literature searches. After screening and examination, 15 papers met the inclusion criteria.

Academic search engines

First we found 1,509 papers through searches of the academic peer-reviewed literature:

- TRID: 281 references
- CINAHL, Sports Discus, Medline, Scopus: 993 references
- PsychInfo: 145 references
- Google Scholar: 90 references

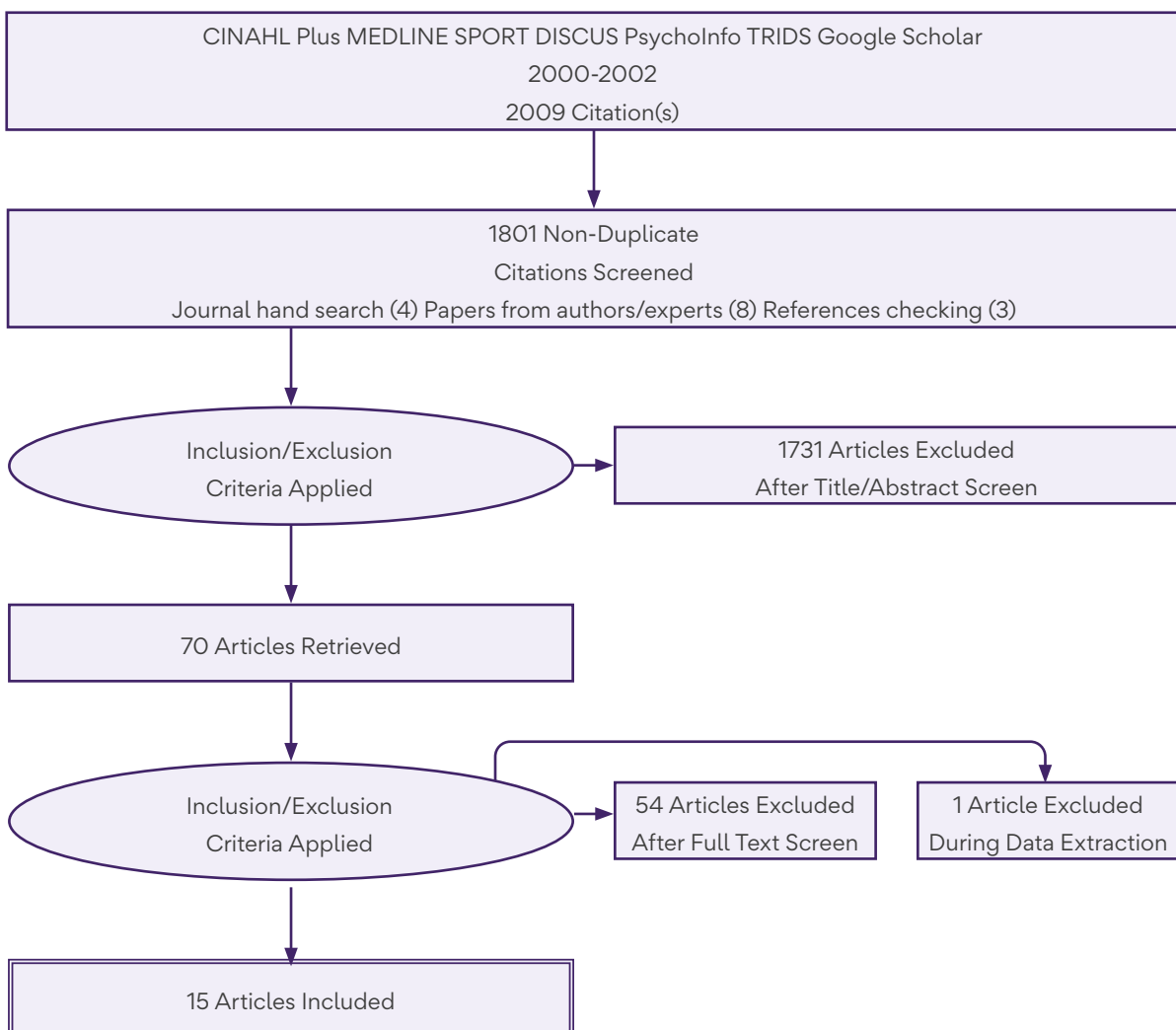
We also reviewed papers identified by the University of Bristol team while conducting a parallel review on physical activity; eight papers identified by the academic advisory group, four from journal hand searches, and three through reference checking. Of the 1,509 papers, 46 were assessed by obtaining full papers. In total, ten peer-reviewed studies were included.

Grey literature

From 500 references through Google/Google Scholar, 150 studies/reports were screened, of which 24 were assessed by obtaining full papers. Of these, five met the inclusion criteria. Of these, two were quantitative studies and three were qualitative. These five studies from the grey literature were included in this review.

Hence, this review is concerned with a total of 15 papers from the peer-reviewed and grey literature (Figure 1). A summary of the included papers can be found in Appendix A.

Figure 1. PRISMA flow chart of search strategy and study selection



Detailed findings: Quantitative studies

This section provides findings from the quantitative studies. These studies were mainly based on surveys of active travel behaviour and attitudes. They provide useful context to the more qualitative evidence-based studies that provide more detailed and nuanced evidence on attitudinal issues. Very few quantitative studies were able to be included as they did not present their findings for the 50-70 year age group. However, detailed analysis of the main UK datasets being undertaken by Natcen will provide the necessary context by describing the travel patterns and key attitudes of 50–70-year-olds.

Transport for London (2015)⁷ presented findings from 1,000 interviews conducted by telephone with a random sample of Londoners in March and April 2015 on the topic of ‘attitudes towards walking in London’.

They reported some age-related findings:

- Londoners aged 45–54 are more likely than other age groups to be in the ‘contemplation’ stage of behaviour change – i.e. actively considering walking more.
- Londoners aged 65 and over are slightly more likely to say they are walking more to keep fit or get fitter (37% compared with 32% of all Londoners).
- Londoners aged 65 and over say that they have more time to walk now (7% of 65+ compared with 4%), but are less likely to say it’s for saving money (3% of 65+ compared with 9% of all respondents).
- Older Londoners (55–64) are more likely to use their car less if they started walking more (31% compared to 24% of all Londoners).

Similar findings come from another large UK city. Greater Sport reported data from a Transport for Greater Manchester survey (2020)⁸:

- Exercise is a motivation for active travel for older adults – people aged 65 and over are more likely to consider exercise as a determining factor in relation to their means of travel (66% compared to 63% overall).
- Health, exercise and fitness are more likely to be mentioned by residents who are aged 65 and over (both as a motivator – and a barrier – to active travel).

Dept for Transport (2017)⁹ is a detailed study of disabled people’s travel behaviour and attitudes to travel. This aimed to begin to address gaps in the evidence base on the travel behaviour of people with disabilities, drawing on recent secondary analysis of five key surveys. The report states that there is a known link between age and the onset of disability. This affects the relationships

between disability and travel behaviour, with reported disabilities and travel difficulties increasing with age. For example, 2% of those aged under 50 report difficulties with transport compared with 5% of those aged 50-69 and 13% of those aged 70 and over. The study found that people who are aged 50 and over and who have a disability are less likely to regard walking or cycling as viable alternatives to short car journeys. When an individual has both of these characteristics this perception is much more marked.

Detailed findings: Qualitative studies

This section presents the findings of the qualitative studies. We identified three key themes organised by transport mode:

- Walking and/or cycling studies
- Electric bike studies
- Public transport and other mode studies

It is of note that none of the studies focused solely on the 50-70 age group. This meant that studies meeting the inclusion criteria often covered a broad range of adults from those in their twenties to those in their eighties. As discussed above, in these cases we only analysed the data from people aged 50-70 where respondents' ages were mentioned.

Walking and/or cycling studies

Jones (2013)¹⁰ employed a biographical interview method, interviewing pairs of parents and children. In this PhD thesis, the author presents a study of the change and continuity in individual behaviour over the life-course as well as inter-generational influence of, and inter-cohort similarities and differences in, active travel behavioural pathways. While the study did not contain participants aged 50-70, it did interview people about their travel behaviour when they were this age, so it was included in this review.

Jones identified various influences across the life-course: changes in home location (urban to less dense), distance to work and number of home moves, as well as disposition, which seems to relate to early life travel behaviour. Throughout the life-course some changes in walking and cycling were attributed to changes in mobility resources, specifically gaining a pass for concessionary fares, gaining or losing a bicycle and gaining a car.

The study included biographies of 'baby boomers' who were in their sixties and seventies. They were negotiating the transition from employment to retirement and recalled childhood and adolescence as a period when walking was a major contributor to mobility. This continued, in conjunction with public transport and

lifts (often from partners), through early adulthood. The timing of the introduction of driving varied across the third, fourth and fifth decades and made an appreciable impression on most walking biographies. The boomers' biographies suggest that locational changes in residence and employment are prominent in changing opportunities and constraints for walking and cycling. They also tended to demonstrate more stability in mid-adulthood when changes in family, employment and housing biographies were less frequent.

Jones (2014) (a paper based on the above PhD)¹¹ provides one biographical account for a person within the 50-70 age group:

Sean was a 56-year-old engineer working full-time, who lived with his wife Jane in the centre of Bristol. His place of work was on the edge of the city. They had three grown-up children and two pre-school grandchildren. Sean grew up in the suburbs of Bristol. His father had always cycled to work. Sean walked to primary school and got his first bike at ten, after which he cycled to secondary school and often went for bike rides. The family got a car, which was only used for family outings and holidays, when Sean was 13. All other journeys were made on foot or by bus. He started as an apprentice with his current employer at 16 and cycled to work from the start. At 21 (1976), Sean married Jane and they moved to an inner-urban area. Around this time he got a car and, for four years, drove to work, lift-sharing with colleagues. Sean returned to cycling to work when this arrangement ended due to the expense of driving alone. This second phase of commuting by bike lasted over 25 years. Sean and Jane moved to an outer suburb area when their children were young. Finances were tight and for a while they shared a car with his parents, having use of it at weekends. Once they had their own car again it was used for family journeys and chauffeuring children, but not for commuting. Sean made some trips within his locality to the pub or shops on foot. In the last decade Sean had stopped cycling to work due to a back injury. He and Jane then moved from the suburbs to the city centre to downsize their home.

Sean considered he had been deterred from recommencing cycling for work by a combination of an increased distance, less appealing route and his increased wariness of traffic. He had since trained for and completed a charity cycle ride and intended to continue cycling recreationally. The car was now used for work, visiting children and grandchildren, supporting elderly parents and going to their holiday home. Sean and Jane often walked in their locality for recreation. A phase of cycling to work endured for a considerable period of Sean's working life.

This coincided with continuity in residential and occupational locations. Distinct developments in his cycling trajectory were getting his first bike, switching to lift-share before relinquishing the car and returning to cycling, his back injury and moving further away from work when he was in his fifties and being prompted to do a charity ride a few years later. Once he had his first bike, Sean walking for transport has generally been limited to discretionary travel within his local area

and recreational walking with his family. Motorised mobility had featured for a limited period at the beginning of his working life and currently towards the end of his career and increasingly for discretionary trips. Sean and Jane had never had more than one car.

Pooley et al (2010)¹² conducted in-depth interviews and household ethnographies between 2007 and 2009 in Lancaster with residents who walked and or cycled regularly. Rather than conducting static interviews, this project explored the experience of moving through the city by using the ‘mobile methodology’ of the ‘go-along’, or accompanied journey, on foot or by bicycle. The majority of those interviewees quoted were aged 50-70.

There were a number of themes identified. Under the theme of ‘Attitudes to cycling infrastructure’, two interviewees reported on their approaches:

“ I’m not a cyclist, I’m not a very confident cyclist so this Cycling Demonstration Town thing has been just fabulous for us and we got new bikes, didn’t we, about three years ago. We did have bikes when the kids were small and we’d take them on holidays with us often and cycle but I’m not great, I wouldn’t cycle in traffic, I would never cycle round Lancaster in traffic, I’m just not confident. But with all these cycle routes we like going cycling, don’t we... I’m not that confident on a bike, I’m a bit wobbly aren’t I?” (Audrey, c. 60)

“ Yeah, but I’m frightened of the roads. It’s because I’m not a confident cyclist, it’s not because the roads are that scary, I don’t think, I think it’s me more than the roads so we tend to cycle paths. Leisure cycling, we go through to Glasson Dock or somewhere like that.” (Kirsty, c. 50)

Under the ‘Time, distance, health and risk’ theme, interviewees reported on their attitudes, firstly with Matthew reporting on time:

“ Convenient. Well it’s simply quicker. You know I wouldn’t have to get the car out or have to find a parking space. I don’t have to fight with the traffic congestion in the centre of town. So I wouldn’t mind walking for journeys that are relatively short.” (Matthew, 54)

Likewise, Amy refers to the ability to have time to observe things of interest on foot:

“You actually begin to see what’s happening within the city, you have time to read the billboards outside the newsagents. You might see something and think “Oh I didn’t know they’re doing that there”. [Traffic noise]... You miss an awful lot by getting in that car and driving. And you meet people as well which you don’t in a car – it’s nice.” (Amy, 55)

Adam focuses on the partial nature of cycle infrastructure and that it often ends where it is needed most in terms of safety:

“The way that cycle lanes have been developed around here it’s very hard not to feel a certain cynicism about it, and feel that cynicism has crept in somewhere. There’s a large number of places in Morecambe I can think of where you cycle along, there’s a cycle lane and you get to somewhere where it’s difficult; traffic lights or bus stops and suddenly it disappears. Well, this is only playing at it isn’t it?” (Adam, c. 60)

Alison and Jan both reference traffic safety, with Alison also mentioning being put off cycling alone on the canal tow-path:

“Not any more I put it [my bike] on Swap Shop and let someone else who was really going to use it get the benefit of it. I had it when we were living by the sea and I, again I think it’s about road sense and stuff. I’m not comfortable in traffic so the kind of bike riding I prefer to do would be on a, away from traffic completely, and, but I know we have the lovely cycle paths and I could have gone all the way to Morecambe and then even along the prom, but I would have had to have got there on the bike and I couldn’t face that and I certainly couldn’t face the getting back. And I really don’t like that river path, the one down by the Lune, either to walk or to cycle I find it very gloomy and threatening and I don’t like it.” (Alison, c. 50)

“Yeah. I’ve had three or four instances down at Stonewell where drivers have gone through red lights and I’ve had to jump back... I was just thinking if there had been a child running ahead, or something like that, they’ll be killed. I really think police should be putting cameras on the pedestrian crossings and on the spot fines for people who jump red lights.” (Jan, 60)

The authors investigated the thesis that while changes to the built environment can have significant impacts on the use of active travel, ideally these also need to be linked to much more fundamental changes to culture and lifestyle. The combination of forces shape everyday travel in a number of powerful ways that almost always submerge the impact of local street engineering and community action. In brief, the concept of ‘automobility’ argues that the motorcar has not only come to dominate everyday travel (at least in the developed world), but also that it is a path-dependent process, locked into a ‘system of automobility’ which is reinforced by taken-for-granted structures of economy, society and culture. This ‘system of automobility’ restricts the development of alternative modes of transport and makes them psychologically less attractive for the travelling public. It explains why community-based social movements for sustainable travel in cities have had limited impact, and why cities have been predominantly shaped to prioritise the needs of motorists rather than pedestrians and cyclists.

Guell, Panter and Ogilvie (2013)¹³ report on the attitudes of 340 active travel commuters in Cambridge, of whom 90 were aged 50-70. Participants were included in this analysis if they reported unsupportive conditions for walking or cycling on their route (e.g. heavy traffic) in questionnaires, walked or cycled all or part of the journey to work and completed qualitative interviews. Using content analysis of these interviews, the researchers investigated their reasons for walking or cycling. The underlying theory was that understanding this resilience might be just as important as investigating ‘barriers’ to cycling.

Quotes are given below from the 90 active travel commuters aged 50-70, illustrating how they were able to maintain this active mobility despite the barriers.

While many participants reported their route to work as unsupportive for active travel, they nonetheless cycled or walked at least parts of their commuting journey. Having explored the reasons why active travellers endured these unsupportive environments on their everyday commuting journeys, the authors suggest that developing commuters’ knowledge of safe walking and cycling routes, improving cycling confidence and restricting workplace parking may form part of larger strategies to encourage walking and cycling to and from work.

By way of example, Greg (aged 61) discussed his routes in terms of avoidance of heavy traffic:

“Well, being a Cambridge lad [boy] I do know all the little snickets [shortcuts] and sideways and I tend to use those... I’ll use the funny little footpaths, the roads that are shut off to traffic, anything that keeps me out of the traffic is good news and I’ll use it... Because I know most of the routes I can duck and dive a bit, it doesn’t speed things up but it makes it safer. As I say, I like to be kept away from the traffic.” (Greg [Pseudonym], aged 61 and cycles 25 minutes every day to work from suburbs)

“ I mean this adds another two or three minutes or more depending on, if you get stuck at the level crossing another five minutes. But this bit’s so much nicer... I will take that time to avoid traffic there.” (Frank, aged 61, cycles four miles every day to work)

Frank also explained how the traffic conditions varied by time of day, leading him to choose different routes:

“ Yes, yes [I have an off-road cycle path], but Long Road is always a bit difficult, pavements are blocked and the road is quite fast so in the day I cycle on the road but in the dark it’s not so appealing and the road [...] is so rough.”

Moreover, participants explained that their experience was very important in enabling them to manoeuvre their bikes through the heavy traffic or dangerous infrastructure they reported in the survey. This may also have applied to other road users.

“ But Cambridge drivers I think are generally aware of cyclists much better than say outsiders coming in. We get the odd one who’s a little bit impatient but there we go, that’s life... It’s when you get out-of-townies who don’t really, who haven’t got a handle on cyclists at all and what they do, that’s when you get problems.” (Greg)

“ Yes, that’s right, so then my strategy and all the other experienced cyclists that I know, as soon as we got into that section of the road, we would cycle out into the middle to stop anybody trying to pass us, because there really wasn’t room and we had priority.” (Gordon, 68 who is given a lift by partner halfway to work and walks the rest of the way, having used to cycle the 6.5 miles from his village to work)

“ Yes, well, from childhood... I cycled to school from when I was a teenager... It’s probably the most dangerous thing I do but... I read the statistics and it’s more dangerous not to cycle from the health point of view! (laughs) And I don’t believe you should give in to things... you shouldn’t allow yourself to be forced off doing it by a whole load of selfish people in cars.” (Frank)

With long-term experience of active travel, confidence could be gained through the knowledge that accidents are not as frequent as public narratives might suggest and while environments might be perceived as dangerous, everyday experience showed that these dangers could be avoided.

“I think in 40-odd years of cycling I’ve only been whacked [knocked] off my bike about three times. I’ve had a few near misses but other than that... it’s not too bad.” (Greg)

Other reasons included a preference for active travel over driving to gain more control over the commuting journey, in particular to save time because an active commute (including park-and-ride followed by walking or cycling) was sometimes the fastest possible way to get to work, because of heavy traffic within the congested city centre:

“Because it’s quicker, I think that’s my primary reason actually. I mean if it was quicker for me to drive, if I wasn’t sitting in traffic queues then I might be tempted to drive more often.” (Isabel, 52, who cycles six miles every day to work from north of Cambridge to the south)

Many participants experienced enjoyment on their way to work and this acted as a good trade-off against other adversities:

“The nice thing I find about it too, it gives me that time to take off my work hat and put my home hat on going home and likewise coming in I can psychologically get myself ready for work.” (Greg)

“[I]f it was a little more dangerous I maybe wouldn’t cycle but I like cycling I mean I’ve always preferred to cycle to work rather than any other mode of transport.” (Isabel)

“It’s much nicer to be independent because you know you want to do things at different times and come home at different times. Yes, she [my wife] wouldn’t mind car sharing so much. And my patience of sitting in traffic jams for 40 minutes isn’t very good.” (Frank)

All participants in the formal content analysis commented (including those aged 50-70) on high traffic volume or dangerous routes in their interviews or photo stories, but also described many examples of reporting environmental perceptions of others:

“There’s so many people I know that were willing to cycle, would like to cycle, but they’re scared.” (Gordon)

“You see I’m, what obsesses me is all the things that motorists do to me. (Laughs)... I’m not alone in that... everybody has experiences, yes, so when they talk about them then you find that all the cyclists will... get uppity very quickly because they are all... it’s a series of frightening experiences and yes it’s certainly put both of my daughters off.” (Frank)

Participants also described their family members' negative perceptions of route safety that affected their own travel choice:

“I blame the narrow cycle lanes, the rough road. And so I hurt myself quite badly then, and now my wife won’t let me cycle in town, she says it’s too dangerous, which I can’t disagree with.” (Gordon)

Some participants were even keen to make a political statement about the adversity of active commuting in their setting. They stressed that ‘something needs to be done’ to encourage active travel and reduce traffic congestion:

“Cambridge has been designated a cycle something city, I can’t remember the right terms, but it means we, we’re eligible for government funding. So there’s a lot of cycleway development going on in the outside villages, but... it’s when you get inside that it starts to fall apart, because you get situations... where the cycleway just disappears... so then you’re mixing it with all the traffic, which can be interesting.” (Greg)

“You can cycle on the pavement, but that’s not practical and I think it’s actually more dangerous. So this idea that people can cycle safely on the pavement where there’s hedges and cars coming out all the time... You should be able to cycle out here... It would benefit everyone, Cambridge is still a complete mess.” (Gordon)

While many participants, including those aged 50-70, reported their route to work as unsupportive for active travel, they nonetheless cycled or walked at least parts of their commuting journey. Having explored the reasons why active travellers endured these unsupportive environments on their everyday commuting journeys, the researchers suggested that developing commuters' knowledge of safe walking and cycling routes, improving cycling confidence and restricting workplace parking may form part of larger strategies to encourage walking and cycling to and from work. They termed this 'journey literacy'.

Jones, Chatterjee, Spencer (2017)¹⁴ conducted a study of cycling, including e-bicycling, with the aim of understanding the contemporary experience of cycling among existing and potential older cyclists and to provide advice to decision makers on how older cycling could be promoted and supported among the ageing UK population. The study conducted 55 interviews or ethnographies with 250 participants aged 50 and over (no upper age limit was given, but one interviewee is quoted as being 83), living in Oxford, Reading, Cardiff and Bristol.

Following the biographical interview, those people who did not cycle took no further part in the study. Participants who currently cycled were invited to take part in a mobile observation. This involved a researcher shadowing them while they made a pre-specified regular cycle journey of their choice. The journey was also filmed using handlebar mounted action cameras – one forward facing camera mounted on the researcher's cycle and another on the participant's cycle to provide both rider and researcher perspectives. The researcher then watched the video with the participant and, using it as a prompt, elicited the strategies and tactics the participant employed when undertaking their journey. The footage was also used as a prompt to try to identify the perceived positive and negative aspects of the journey experience and the feelings generated in response.

Data on attitudes to cycling highlight that a high proportion of people age 60 and over lack confidence to cycle on roads and feel that it is unsafe to do so^a. This, coupled with higher likelihood of disability or health condition, means that a high proportion of the older population would rather use public transport than cycle. Yet, the researchers noted, there is potential for cycling to contribute to reversing this trend owing to the fact that around 40% of people aged 50-59 and nearly 30% of people aged 60-69 in England own a bicycle, but only 3% use them. Cycling, the researchers suggest, could clearly play a role in providing the older population with an opportunity to take part in healthy recreational activity and as a means of everyday mobility.

Participants were categorised into three types of rider. Resilient riders were participants who engaged with cycling throughout mid-to-late adulthood and were still cycling at the time of the study. Re-engaged riders were participants who started cycling again after a period of five years when cycling was either absent or had significantly diminished. Reluctant riders were participants whose cycling had been curtailed or absent in the last five years and who stated that they had no intention of resuming cycling.

Vignettes of riders from each category are provided from the 50-70 age group.

Resilient Rider Alfie, 70, Bristol

Alfie, 70, was a retired engineer who lived with his wife in an outer suburb of Bristol. They had lived in the same 1960s townhouse for over 30 years. Their house had a driveway and was situated on a residential road at the top of a steep hill on one of Bristol's designated cycle routes. Alfie had almost exclusively cycled to work throughout his working life, apart from a gap of five years in his twenties when he was forced to stop cycling due to a back problem. His residential and employment situations were constant for the most part and he recalled some efforts to improve cycling facilities in the workplace prior to his retirement:

“... the last several years they [the company] encouraged it a lot more, putting in showers and things, but there were always people who cycled to work and some a much greater distance than me.”

Alfie had also taken part in different forms of recreational cycling, including mountain biking, and had been on cycling holidays abroad, both alone and in the company of others. Alfie noted how he had continued to cycle after retirement by cycling up to 3 miles to the place where he was volunteering and to reach the various activities that he was involved with:

“I started doing other activities right away, I started volunteering at a place in Bishopston so that was 2.5 miles to get to that. They [cycle journeys] just changed a bit, I stopped doing that journey into [work] and did other journeys instead but they were similar, within the bounds of Bristol, just different journeys, not better or worse.”

Alfie's cycling was contingent on whether he was travelling alone or with his wife and also on his own physical limitations forcing him to adapt to the circumstances. His wife's cycling was now limited to off-road paths for leisure because she was no longer confident cycling on the road, so most everyday journeys together were by car or public transport. Although Alfie was generally unperturbed by cycling on busy roads within the city he was aware that his physical stamina had diminished. He linked this to a respiratory illness a few years earlier which had reduced his lung capacity and he therefore had to get off his bike on some hills to walk. To compensate, Alfie had altered his route into the city:

“Henbury Hill... I used to look upon it as a sort of fitness challenge... now I tend to push up or avoid it by taking a slightly different route, more of a gentle climb part of which is a designated cycle route... so I can cycle up that.”

Despite these limitations, Alfie expected to continue cycling for the foreseeable future and contemplated his strategy to maintain cycling when his health had reached the point where cycling was difficult or no longer possible:

“I can't see it changing in the next five years, unless my health rapidly deteriorates... I might have to think about getting an electric bike. I've resisted getting one up until now. I'll walk up some hills, pushing the bike. Well, so what? It's still exercise! I think I will leave it [getting an electric bike] to when I can't actually face it, cycling... it will be my health that will curtail my cycling.”

Resilient Rider Janice, 65, Oxford

Janice, 65, retired as a social worker in 2010. She had lived with her husband in an end-of-terrace house in central Oxford for 12 years. She learned to ride by the age of five when living in south-west London. She did limited cycling while away at boarding school, but went on cycling adventures from home in the holidays. Her cycling declined after she got a car aged 17. Working as a social worker in London, she chose to drive and walk for personal safety, cycling a little with her young son on a bike seat for leisure. She met her husband, a keen cyclist, when they were both aged 35 and they moved to a small village in Oxfordshire where their son was born. Initially they both had poor quality bikes and did not use them very much, apart from the odd leisure journey with their children. Janice and her husband each had a car which were used for commuting and most of their other journeys.

In 2003 Janice and her family moved to central Oxford. Janice described the effect this had on her mobility:

“Huge... [for] the first time in my life a bike became my main form of transport and I loved it... quick, no parking problems... small city, short distances, not hilly.”

They continued with two cars for about five years, which Janice reflected on as ‘crazy’ because her driving had now greatly reduced, and she was frequently cycling from her home to her workplace in the centre of Oxford and also to travel around the city. She and her husband also went on local leisure rides along the city’s riverside paths. This meant that Janice’s car use had become limited, with almost all of her mobility being conducted by bike, except for the occasional bus journey. She put this down to speed, time availability and described herself as ‘totally cycle-orientated’ and, together with her husband, she had developed knowledge of lots of shortcuts for cycling within the city.

At the age of 55, after moving to Oxford, Janice had received a hip replacement because of the onset of arthritis. This meant that cycling had also substituted walking and she described how, as she was getting older, she still found cycling

a much easier way to move around the city than walking. She felt her cycling was not going to change in the near future unless she lost confidence or cycling became more physically challenging. For Janice, cycling was a key component of her wellbeing, stating that she would be, ‘miserable if I didn’t cycle’. Cycling for both transport and recreation provided her with the opportunity to experience fresh air and social contact and a feeling of being part of the wider community, as she put it, ‘on a bike you are there, you are part of the place you are in’.

Despite cycling being a key component of Janice’s life, she was critical of the conditions for cycling in Oxford. She thought that traffic had become more hostile and facilities to support cycling were inadequate and was critical of the, ‘... disproportionate amount of road given to cars’. During the interview, after the mobile observation of her ride through the city centre, she gave an example of this on one section of road where she pointed out that the space available was:

“Wholly inadequate for wobbly bicycles, you can see the amount allocated to me [advisory lane]... look at the speed people are overtaking, you know, they are doing 30mph... If I wobble what do they do!”

In summarising, Janice reflected on her own cycling capability and experience and what it might mean for someone less capable attempting the same route:

“You’ve seen a very good example of how crap Oxford can be... the only thing that makes it do-able is that I’m entirely used to it, I mean somebody new negotiating Oxford, Jesus! What a nightmare that would be! They’d probably get off and walk, it is just too dangerous... I don’t think the city planners have ANY IDEA what it is like on a bicycle.”

Re-engaged rider Gill, 61, Oxford

Gill bought a new bike to take part in the pedal cycle well-being trial. She had lived on her own in Barton, on the eastern edge of Oxford for 11 years, doing very little cycling during this time. She had grown up in East Oxford and had used a bike extensively during her twenties for work undertaking postal deliveries and for transport. She had cycled with her second child when he was younger and used a bike for social visits until giving up on cycling when moving closer to her family. Suffering from agoraphobia, Gill hadn’t used public transport for many years and had relied on taxis for the last decade. After hospitalisation with a serious health issue within the last two years, she had been encouraged to use a static bike to build up her muscle strength again. She was now doing voluntary work at a local health and wellbeing centre. Gill smoked, and her other exercise was housework along with walking in her local neighbourhood. She talked about re-discovering the joys of cycling and its many benefits, comparing being out and about on a bike with an exercise bike indoors:

“I had a lot of trouble with muscle weakness and I had a pretend [exercise] bicycle at home [laughs] which I never used. It stood in the corner and I kept thinking “yeah, ten minutes each day”, but I never did but when I got my cycle that gave me the motivation because I knew I was going somewhere and that has helped me tremendously. My legs are better, I feel better... you get everything all-in-one with a bicycle. It keeps me fit, I bake lovely cakes and then I cycle... to make it go away!”

In addition to fitness benefits, Gill explained how cycling provided a sense of connection, independence and freedom:

“It’s just been... a good experience all round for me because it has opened my eyes, when I was getting a lift before, you don’t see anything, with my bicycle I have been managing to see the roadsides, all the lovely flowers... It has given me an awful lot more independence, the independence is the important piece because before I was waiting for lifts, now I just jump on my bike, it’s lovely.”

“It’s given me my freedom... I can go anywhere now, I can cycle to my friends, I can go to the shops when I need to instead of asking others... a new way of life... the independence and freedom it's... wonderful.”

Despite her newfound freedom, Gill explained that her main obstacle to cycling was the weather, especially the wind, but that she could use buses and taxis in these circumstances. Moving the bike from its secure storage in a shed in her back garden to the road at the front of the house was also a challenge as she had to manoeuvre it over several steps. With her detailed knowledge and previous experience of cycling locally she had easily identified a route to her voluntary work, which she felt was acceptably safe and comfortable, mostly using an off-road cycle track along the ring road. However, this involved negotiating a large roundabout, which required her to dismount and wheel her bike through underpasses. The ring road also acted as a barrier on another key route for her to access the local shopping centre, necessitating use of another underpass.

Gill’s perception was that there were very few people using cycles on her estate and the reliance on cars, particularly for transporting children to school, caused congestion. She thought that the attitude of motorists towards cyclists had worsened considerably compared to when she used her bike to commute to and from work in the 1970s:

“[I have a] right to be on that road and those drivers had a right to respect me... I think why shouldn't I be able to ride peacefully without being honked at or abused.”

Gill explained that her strategy when she felt unsafe was to ride on the pavement, but she believed that more road space needed to be allocated specifically for cyclists.

Re-engaged rider Wilfred, 64, Bristol

Wilfred lived in a neighbourhood on the north fringes of Bristol with his wife Chloe. He had retired seven years before, having run a small retail business for 25 years. Wilfred did not cycle for most of his working life and considered his opportunities to cycle limited because of the nature of his work - he often worked seven days a week and had to use a van for transporting stock. He had regarded himself as a sporty person, playing football and squash regularly for decades in adulthood, until he was forced to stop due to deterioration of his knees. His wife, however, took up cycling for fitness and charity fundraising in her 40s. As he approached retirement, Wilfred required successive knee operations and his wife and daughters bought him a bike to try to encourage him to cycle with them:

“I didn’t really cycle until it would have been about 2008, the kids bought me a bike ‘cos [partner] was biking plus I already had my bad knees – I’d already had a half replacement in my left one. They bought me a bike and I started just doing a little bit of biking cos I was working still, just out with the kids and that...”

Despite Wilfred’s use of the bike being fairly limited at first, it increased in the years following his retirement at 57, mainly through cycling holidays with friends as he explained:

“Well I was cycling before I had the second one done [knee operation], because it was low pressure on the knees, so I could do it and we had friends who were cycling, so we decided to start going on cycle holidays... we were just doing holidays and the odd bit of cycling with the kids.”

Wilfred thought that his engagement with cycling was due to a combination of encouragement by his wife and the access they enjoyed to the many off-road cycle paths near their home to the north of Bristol. Together they had established a routine of two rides a week of 1020 miles for recreation, mainly sticking to these paths.

The vignettes provided – four in the 50-70 age group – identify a group of people who have a positive attitude antecedent to cycling. The researchers note that it is clear these examples are the exception rather than the rule. Despite the barriers that have been identified, these participants managed to continue to cycle, or re-engage with cycling, seemingly against the odds, and how they have continued to do so has been highlighted. The ability to cycle in these circumstances is largely contingent on physical capability, spatial opportunities along with the fact that many older people also adapt their approach to avoid difficult situations (e.g. hills) or threatening scenarios (e.g. heavy traffic). They argued that promoting and prolonging cycling as part of an age-friendly city agenda will require more substantial measures that accommodate a wider range of cycling capabilities.

The overwhelming desire is for better quality cycle provision that is safe, easy and comfortable to use. This will require investment in dedicated cycle tracks separated from motor traffic and pedestrians on all busy roads. This might apply, for example, on arterial routes in and between towns and cities along which many activities are located that people access. Such tracks will need to be sufficiently wide to cater for all abilities and to support more sedate, social, side-by-side cycling. Along these routes, the researchers add, the aim should also be to ensure that the momentum of cycling is maintained so that cyclists do not waste energy through continual starting and stopping. Separated routes will also need to be coupled with the widespread roll-out of 20mph/30kph zones (and below) in urban areas and smaller towns and villages. This is necessary not only from a road safety perspective but also to foster less frenetic and harried conditions in public space where ‘less speedy’ cyclists do not feel pressured and threatened by motor traffic and other cyclists.

However, more sophisticated methods of enforcing vehicle speed will be necessary rather than focusing on vertical deflections as a panacea as these can be uncomfortable for older or ailing cyclists. Urban spaces will also need to be designed so that it is clear where cyclists are meant to be, that is, they should be clearly signposted and legible on the ground. It is important that there is consistency in surface quality and colour. Infrastructure for cycling needs to be well-maintained so that surfaces are free of potholes, clear of debris and are smooth and flush – time and time again our participants spoke of poor and deteriorating surfaces, uncleared debris and overhanging vegetation that added to their discomfort and fear of falling off.

The UK Dept for Transport (2010)¹⁵ conducted a study called ‘Safety and Sharing the Road: Qualitative Research with Cyclists and Other Road Users’. This qualitative research was carried out with cyclists and other road users (ORUs) as part of the wider research programme. There were 103 participants in all, but we present the findings from nine people aged 50-70 here. Two participants noted that health was their main motivation for cycling, either mental health/stress or broader benefits:

“If I’m a bit stressed and I go out for a bike ride, I do usually come back quite a calmer person.” (F, 57, Cyclist, Surrey)

“I’ve got Parkinson’s disease, yeah, for the last three years. Cycling’s good for me, it gets me moving, though I can’t turn around very well... I cycle around the canal paths most of the time.” (M, 57, Cyclist, Surrey)

The main barrier to cycling was fear of traffic:

“I now live in Kensington and it was probably about 18 months ago that I sort of had this bright idea to get a bike – so my friend who lives in Notting Hill, and I’ve got one that lives down Holland Park – I thought, well, I’ll cycle rather than drive... I go through Hyde Park. I mean, I’m one of those awful ones that actually do go on the pavement, because I’m very nervy, no, I am... If it’s really busy I’ve been known to get off and just walk with it because it’s hazardous and I’m a bit apprehensive.” (F, 58, Cyclist, London)

There was also seen to be a need to ride in a defensive or non-aggressive manner:

“I think that people just ride in the middle of the road, it’s got to happen like drivers if they can’t get past you when there’s no need for it, I mean, that’s going to wind him up, I know it would wind me up. So, if you can keep out the way, you’re doing as much as you can.” (M, 57, Cyclist, Birmingham)

One quote from someone classified as ‘Other Road User’ (i.e. non-cyclist) provided a unique perspective into the hostility some cyclists might face:

“I have nothing against cyclists whatsoever, everyone has a right to the use of the road, but when you think of the amount of accidents they do cause, there is no registration, they don’t pay anything at all to use the roads, they’ve not paid to have a cycle lane fitted, all the car drivers pay for that.” (M, 55, ORU, London)

Transport for London (2016)¹⁶ conducted the study ‘Older Londoners’ perceptions of London streets and the public realm’ to provide a map of the diversity of safety-relevant motivations, attitudes, perceptions and behaviours among cyclists and other road users (ORUs). They combined desk research with 20 accompanied journeys and three focus groups with people aged 65 and over. As above, we include the data from participants aged 65-70 here.

As with cycling, health was the main motivator for the people interviewed in this study:

“Walking is a celebration of your health and ability to get out.” (Frances, 69)

“Knowing that I am getting exercise every day and keeping up my physical health. It’s good for the mind as well, I love hearing the birds, seeing the changes in seasons. That’s why I like the nature reserve so much. You can forget sometimes you are in London. I use the equipment in the park every day and then I will have a little sprint, just at the very end. It’s good to get the blood rushing. I like the routine of doing this every day, it doesn’t matter what the weather is like, I go every day.” (Rodney, 70)

“We’re assured it’s good health wise as well! It keeps you moving and active.” (Gordon, 65)

When asked ‘what does walking in London mean to you?’ the three participants aged under 70 gave quite different perspectives:

What does walking in London mean to you?

“... an absolute pleasure. Every day I walk an hour, across the road to the local Nature Reserve (Fox Hill Park) and then go to Ealing Broadway to pick up the paper. Sometimes I will stop at the café and get a coffee. It takes about an hour. I think about doing it every day, it’s important to get out and about and keep fit and active. It helps me to feel part of something. I see people I know in the local community when I walk down to the shops, which is always a pleasure. When walking further afield it’s great to meet new people and learn about the local area from them. I’ll get on the Tube and go into Hyde Park or Kensington High Street. I love seeing London and being part of the city.” (Rodney, 70)

“I don’t enjoy it or not enjoy it, it’s just a thing you do. But if it was taken away from me, I think I’d miss the freedom and the autonomy. I walk more when I visit the grandchildren. We go to Enfield Park and I can’t take the car because I don’t have child seats. When you get there it’s stunning. It’s a completely different experience to Lewisham. If you haven’t been somewhere before, walking is more exciting. I’ve lived here all these years, but I haven’t seen the other part of the Heath. There’s a novelty value. My favourite walk would be one I hadn’t done before There’s miles of walking on the Tube between platforms. I’d rather do it above ground.” (Patricia, 69)

“A normal part of everyday life, and an enjoyable part at that. I always walk to work and I love walking around central London. My favourite walk there is to Somerset House – I like to make a trip of it, getting off the bus in Cambridge Circus and going to my favourite CD shop on the way. Walking not only allows me to experience London’s sights but also its ever-changing noises, textures and colours. If you’re walking you can stop at your own leisure and enjoy it all.

I like to people watch, see what's going on and take it all in. It's more social as well – you can stop to talk to people and see what's changing in your neighbourhood.” (Gordon, 65)

Finally, research participants gave a range of reasons for not walking as much as they would like to:

“ Nothing really, I make sure I fit it in every day. I don't want to moan too much about the streets, sometimes they look a bit scruffy, but it doesn't bother me too much. It's a shame my wife doesn't like walking with me, it would be nice to go out with someone every day.” (Rodney, 70)

“ I'm lazier than I am committed. I wouldn't walk if it was piddling down with rain or if it was particularly windy. I stopped smoking in January and it's made me feel worse. I'm coughing and wheezing more when I walk.” (Patricia, 69)

“ I always walk shorter journeys – if it's 10-15 minutes nothing would stop me from walking. If the journey is longer, I might take a tube or bus. But sometimes I'll get off a bit earlier and walk the rest if it's a nice day and there's something to see. Some of the things that do annoy me are litter on the pavement, people spitting and too many street signs – I'm sure they're unnecessary and they just look untidy!” (Gordon, 65)

Lyons et al (2008)¹⁷ conducted a review of available evidence on public attitudes to passenger transport (including walking and cycling) for the UK Department for Transport. This included a set of national repeated cross-section surveys, and a selective literature review of journals, books and topic reports. Although the review covered all ages, some of the findings can be applied to people aged 50-70. In particular, age was seen to be a key factor in attitudes to driving. Motives for car use were seen to be deeply rooted in psychological and emotional attachment, working differently at different stages of life. The youngest participants in the research liked driving for the sake of it, seeing it as a pleasurable mode of transport. Meanwhile, older people were more likely to only drive when they had to. Psychological aspects such as freedom, privacy and comfort emphasise the importance of using a car.

Older participants suggested that using the car had become habitual and was linked to lifestyle. The freedom to drive when, where and how often they like was

reported as extremely important by participants. This was linked to being able to be independent, particularly among the oldest (65 and over) and youngest (18-24) age groups. The reliance on the private car was seen as great attachment coupled with great anxiety over losing such freedom, especially among male drivers.

Cavill and Watkins (2007)¹⁸ conducted qualitative focus group research with a range of people who use the Liverpool Loop Line, a cycling and walking path in a deprived part of North Liverpool, UK. This included ten people (five men and five women) aged 50-70. Similar to the above findings, they found that feelings of freedom and health were motivational for people, especially if they related this to previous cycling experiences:

“ I enjoyed the freedom, I enjoyed cycling, and I... used to love being on the bike... and we used to be riding round the country lanes, you know, and that used to be gorgeous, I loved it.” (50+ woman)

The main barrier to cycling on the road for transport was seen to be safety, and particularly the volume of traffic:

“ ... I think the roads are dangerous... I don't drive, but being a passenger, it's bad enough... they're not made, are they, for the volume of traffic? You're all right on the cycle lane, you know if you have a cycle lane, but it's when you come to lights or a roundabout...” (50+ man)

The study explored the role of off-road cycle paths – particularly the type of converged rail trail found in Liverpool. Here there were reported to be conflicting views, with some people seeing them as safe and convenient and others pointing out the additional safety concerns caused by crime and anti-social behaviour:

“ Well, it was lovely when they first did it... well it was pleasant, and you know, safe enough, you felt safe... must be ten years ago.” (50+ F)

“ ... you're talking about cycle paths, but you couldn't go there on your own... it's not very nice, there's horrible people on the cycle paths.” (50+ M)

Finally, this sample included some extremely committed cyclists who underlined that they felt ‘once a cyclist, always a cyclist’:

“I trained every day, only 30 to 40 miles, if I could fit it in, every day, or if not, it was every other day. I rode time trials: 25s.” (50+ M)

Electric bike studies

Jones, Harms, Heinen, (2016)¹⁹ investigated the motives for e-bike purchase, rider experience and perceived impact on mobility, health and wellbeing through in-depth interviews with e-bike owners in the Netherlands (n=22) and the UK (n=10). The UK participants included five adults aged between 50-70 living in Oxford. Most participants were in full or part-time employment. Nearly all held a full driving licence and only five lived in households without access to a car. Semi-structured interviews of approximately an hour focused around three themes: motives for purchase, perception of impact on travel behaviour and user experience. One of the areas of exploration was about the magnitude of effect of e-biking in substituting car journeys and indeed whether e-biking has impacted household car ownership.

The researchers reported that among the UK users there is a sense that e-bikes offer the opportunity to maintain or increase levels of cycling for non-car-based everyday travel and recreation, particularly when faced with reduced physical capacity or complex travel patterns that make conventional cycling more challenging. Their findings corroborate previous studies that suggest that the main motivation for engaging with e-biking is the option it provides for overcoming longer or more complicated journeys (typically 10 km or more) that would otherwise preclude conventional cycling because of the time and physical exertion required.

A common perception across the participants was that e-biking has increased personal physical activity, or at least enabled previous levels of cycling to be maintained. E-bikes are perceived to promote engagement in cycling by encouraging more frequent and longer journeys and also allow participants the confidence to discover areas previously untapped by conventional cycling. Positive effects on personal wellbeing were evident in participant narratives around the ‘joy of riding’. E-biking could therefore have positive benefits and although the researchers presented no measurable outcomes, their qualitative findings perhaps elaborate the positive cognitive response attributed to e-biking in other quantitative studies.

Quotations are grouped into loose themes, starting with advantages of distance and speed now able to be travelled by e-biking:

“ My mother lives in Abingdon [6 miles away]. Whereas before I probably wouldn't have tackled the journey on my ordinary bike, I feel that I can easily get there and back by using the e-bike.” (Bradley, 61, Oxford)

“ I guess the initial reaction is that it's cheating, partly because I'm part of the cycling group/culture and [they] think it's cheating... [and that] anyone who is capable of cycling above 15 miles an hour without too much effort and is fit probably doesn't need an electric bike...” (Sam, 57, Oxford)

Disadvantages included the weight of lifting the bike and aspects of charging the battery:

“ It's a big, heavy thing and it's, well you know, it's just the main weight of it. That is the one disadvantage. If you've got to lift the bike over a threshold or something, it's a bit of a hassle.” (Calvin, 70, Oxford)

“ That's the only hassle, remembering to charge it because if you've got back and you've only got a range of five or ten miles then I can't get to work.” (Sam, 57, Oxford)

“ The annoying thing about that is if you're doing a long journey, you actually have to remember to take the charging cable with you if you think you might run out and the charging cable is really heavy.” (Roberta, 50, Oxford)

Safety was not absent from the concerns of some of the e-bikers and the need for safe infrastructure was cited:

“ The only times where it feels dodgy is when [...] the cycle paths aren't wide enough and/or car drivers or van, bus, lorry drivers, anyone are just not considerate of cyclists.” (Roberta, 50, Oxford)

“Sometimes those supposedly quicker routes, the cycle paths, are not wide enough or they're muddy or they're not as well cared for and things like that, so sometimes you're better off being on a road than on a cycle path.”

(Roberta, 50, Oxford)

“I mean the big resistance to cycling is... a lot of people just feel... don't feel safe cycling. Now I think electric bikes can help that a little bit because it enables someone to feel a bit more confident, but a lot of people simply say, “no, I'm not going to cycle on that main road” whatever... “I need a cycle track” so that has to go hand-in-hand.” (Sam, 57, Oxford)

Findings revealed that the motive for purchasing e-bikes was often to allow maintenance of cycling against a backdrop of changing individual or household circumstances including those in the UK 50-70 age group as illustrated through the quotes. E-bikes also provided new opportunities for people who would not otherwise consider conventional cycling. Perceptions of travel behaviour change revealed that e-biking was replacing conventional cycling but was also replacing journeys that would have been made by car. There was also a perception that e-biking has increased, or at least allowed participants to maintain, some form of physical activity and had benefitted personal wellbeing. Technological, social and environmental barriers to e-biking were identified. These included the weight of bicycle, battery life, purchase price, social stigma and limitations of cycle infrastructure provision.

Public transport and other mode studies

The experiences of everyday travel for older people in rural areas was investigated by Graham et al (2018)²⁰ using a systematic review approach that reported on ten studies from 12 papers. Participants were aged 60 and over and primarily used their cars for transport. However, only some of the studies could be included in this review as they applied to people aged 60-70 and covered active transport. There were eight studies that were solely qualitative and four with mixed methods. The majority (seven) of studies conducted semi-structured interviews with participants. Other methods of data collection included focus groups (five), questionnaires with qualitative questions (one), and participant observation (one).

The car dominated in nearly all of the studies and ‘was seen as essential for rural life’. The review suggests that while people travel to reach destinations they also experience and enjoy the process of travel for its own sake, with older people describing its contribution to their well-being. Older people tend to make

shorter local journeys, making active travel more of an option, with the positive side-effect of maintaining fitness and physical capabilities. However, the authors noted that improved conditions for walkers and cyclists in the built environment may be necessary if these modes are to become more important for utility travel in rural areas. Barriers in the walking and cycling environments, such as a lack of pavements, cycle facilities, and street lighting, combined with exposure to high motor-vehicle speeds, were reported by some interviewees as inhibiting the use of these modes:

“ You couldn't walk; you have got to be very vigilant walking this road because they just come up the road as if they are on a motorway.”
(Female, aged in sixties, Monmouthshire)

A second paper by Graham et al, (2020)²¹ drew on the same data set as for Graham et al (2018) and for those aged 60 and over but living in urban areas, with 14 papers reporting on 12 studies. Unfortunately, most of the evidence cited was not made specific to the 60-70 age group.

The authors identified four inter-connected themes focusing on the intrinsic value of travel. The first related to ‘getting out’ and being an independent traveller, with travel in the local environment not seen simply a means to an end. Travel was seen as an act and an experience from which older people derived enjoyment that contributed to their well-being. The second relates to the importance of remaining independent, despite mobility limitations and financial constraints. Participants valued travel systems and environments that support, and do not compromise, their strong preference for independence. The third and fourth themes highlighted the ways in which environmental and transport-related factors mediated older people’s travel experiences – and therefore determined the extent to which both the intrinsic and extrinsic value of travel could be realised.

Studies that focused on older people’s experiences of their local environment and local travel systems respectively contributed most to these themes. Older people’s concern for their personal safety was discussed in the majority of studies. These described how fear was environmentally determined, with particular times of the day (after dark and at night) and settings (e.g. being in proximity to groups of young men) perceived as particularly unsafe. Lastly, compared to those living in more advantaged areas, older people in poor urban environments described a pedestrian infrastructure that was more hazard-strewn and harder to navigate, particularly for those with mobility needs.

Jones and Ogilvie (2012)²² studied commuting in and around Cambridge, including the active travel component of the journey. The study reports on a qualitative interview study which aimed to explore experiences and processes of

selection and change of travel modes for commuting, focusing on the period of home or work relocation. The study explored the hypothesis that moving home or workplace is a period when people (re)assess, and may be more likely to change, their travel behaviours. Some may seek to reduce their reliance on car use. Three of the 26 participants were aged between 50 and 70 (52, 55 and 57). For example Kate, explaining the considerations for changing commute mode, said:

“I could drive here but then I have to park somewhere... I suppose I could get the bus, but it would probably take as long to come by bus as it would for me to walk anyway... yes, so walking is the most practical way.” (Kate, 52, walked both before and after moving home)

A case study is provided that illustrates how this applied to a single participant. Mike, aged 55, moved home from a town eight miles from Cambridge city centre to a town 16 miles from Cambridge city centre. From his first location he travelled to work using a motorbike and upon relocating he started using the train to commute to work:

Mike, aged 55, moved home from a town eight miles from Cambridge city centre to a town 16 miles from Cambridge city centre

‘So it’s about a 15 minute walk to the railway station and then catch the train into Cambridge, then it’s about another 15 minutes from the railway station to here. So it’s walk, train, walk... The train works out cheaper and it’s also quicker. Because parking is difficult in the centre of Cambridge, on this site in particular, it would be difficult to bring the car in and it’s slower and more expensive so yeah, that’s the main reason... Before I lived there I would come in on the motorbike... That was quite good but really it’s just more convenient on the train... It’s a major consideration, where I live to how easy it is to commute in... [When I moved home] I was intending to use the train... But I was surprised how good it was. It’s excellent... Because I think it’s sometimes difficult to fully work out how convenient places are going to be to live until you’re actually there, that’s when you find the problems.

You know, it could be just a very unreliable line, some of the train lines are more unreliable than others and you don’t really know that until you start using them regularly... It’s nice if you can get the seat on the train. I have actually changed, I used to catch a slightly later train which you’re guaranteed a seat on but that’s the school train so... that’s quite noisy and full by the time it arrives... But it gets in, yeah, about 20 minutes later... I think my health has improved since I’ve been doing the regular walking, yes. Yeah. Yes. Certainly weight-wise. (Laughs) Yeah, I think I have become a bit fitter, certainly since I’ve been doing all the regular walking, yes.’

Mike prioritised his commute to work when selecting his new location – similar to other participants, he considered the ‘ease’ of getting to work, rather than preferring a particular mode. He made plans to commute by train before he relocated, but made some subsequent adjustment by changing to a train at a different time. He explained the reason for this adjustment as:

“... it’s difficult to fully work out how convenient places are going to be to live until you’re actually there.”

This may also explain why other participants adjusted their commute slightly, or totally, despite having had knowledge of and plans for their new commute before relocating. Mike’s reasons for changing to the train were that ‘it’s cheaper and it’s also quicker’, in keeping with the overall motivating factors when selecting travel modes being cost, convenience, speed and reliability as described above. He experienced an incidental increase in physical activity associated with the commute, from zero to sixty minutes per day. This increase in physical activity was unanticipated, but he recognised increased fitness and weight loss after commencing his new commute. His commute distance increased following relocation, but public transport enabled him to incorporate physical activity into his commute.

Key themes

The analysis above has presented and described the detailed findings from the components of the reviewed studies that applied to research participants aged 50-70 in the UK in the context of active travel. In this section, the findings of the studies included in this review are synthesised under some main themes. These were created from a thematic analysis of the data. All quotes and any accompanying analysis were read by both reviewers and codes applied to interesting themes that emerged from the data. These were then combined under the two most important meta-themes: motivators for active travel and barriers to active travel.

Motivators for active travel

Health

The most important motivator for active travel among the participants in these studies was the wide range of health benefits that could be accrued through walking and cycling. Participants broadly recognised that active travel is ‘good for them’ and talked of the feelings of health and vitality from getting out and about. However, it is interesting to note that these health benefits were usually viewed in very general terms: ‘getting exercise’ or ‘getting the blood rushing’ or ‘helping the weight’. It might have been hypothesised that people aged 50-70 are more likely than younger people to intentionally take up physical activity in order to reduce their risk of developing or exacerbating specific health conditions (such as obesity or heart disease). However this was not the case; we found only a small number of references to a preventive approach, including strengthening legs and knees (including post-operatively) and reducing the impact of – in one case – Parkinson’s disease.

The more prevalent attitude among participants seemed to be a general appreciation of feelings of vitality that being active provided. Participants seemed almost as likely to refer to mental health benefits (and stress reduction) as the potential improvements to physical health. They talked about:

- ‘taking off the work hat and putting on the home hat’ (when commuting home)
- stress reduction
- ‘good for the mind... hearing the birds’

This links very closely to the next theme of enjoyment of the outdoors through walking and cycling.

Enjoyment of the outdoors

The enjoyment of being outside was also an extremely strong motivator for both cycling and walking. This enjoyment revolves around a number of different experiences, including:

- Being literally out of the house or workplace away from domestic or work constraints
- Being in green space
- The feeling of freedom
- Getting some fresh air
- Seeing what is happening in the local area
- Social contact – bumping into people
- Feeling part of a community: ‘on a bike you are part of the place you are in’

Independence

This appreciation of being outside is also closely linked to feelings of independence that come with getting out and about and being able to wander or ride freely. This was very strongly felt among committed cyclists, but was also quoted by walkers (especially the sample from London). Cyclists talked of being free from traffic jams, the ability to choose traffic-free side streets and to lock their bikes wherever they want. Some participants spoke of feeling in control and free from worries about where to park or having to wait for lifts. They ascribed an intrinsic value to travel in itself and not just as a means of getting from A to B. For many short journeys, walking and cycling was seen as quicker and more convenient than car travel.

Environment

There were virtually no references to the environmental benefits of cycling and walking within this review data. It appears that enjoying the outdoor environment is much more of a motivator for 50-70 year olds than protecting the environment. There were few or no references to 'saving the planet' or 'reducing carbon', and more to enjoying being outside and enjoying the local environment.

Life-stage

It can be argued that 50-70 year olds are likely to be at least considering, if not actively preparing for, retirement. This issue did appear in the reviewed studies but it was not perhaps as dominant a theme as might have been expected. Many participants referred to active travel having a much more dominant role in their younger years, either through necessity (not being able to afford a car), youth (having more energy and fitness to walk or cycle) or societal trends (cycling and walking being more common and perceived as safer). Some of the 50-70 year olds interviewed in these studies referred to periods in their lives when changes in family, employment and housing led to changes in travel patterns – for example, moving closer to work led to the possibility of walking or cycling to employment. However, the 50-70 year age group is quite stable when it comes to travel habits, so opportunities for changes due to life stage are rare.

The exceptions to this stability are the participants in the studies who made a deliberate choice to become more active on retirement. Some participants referred to walking more, but we found more examples of people who had bought (or been bought) a bike when approaching retirement. This is perhaps due in part to the fact that taking up cycling is a more tangible behavioural change than simply walking more. Even in studies with titles that indicated reporting on walking and cycling, it was notable that much of the focus was on people using bicycles. Behaviour change among bicycle users is also made easier by the increasing trend towards e-bikes, which help to reduce barriers like hills and distance and hence increased freedom to travel further and more easily. There was even one example of a man who planned to buy an e-bike when he was unable to ride his 'normal' bike so that he could keep cycling.

Specific cycling issues

There are a number of findings around motivators that apply only to cyclists – specifically regular cyclists. This group is a small minority, but provides a very interesting insight into how to overcome barriers to cycling (as discussed in the next section) and how specific benefits of cycling manifest.

Specific influences on cycling behaviour included:

- Cycling in earlier life – regular cyclists often referred to a time when cycling was a routine part of life.
- Identity as a cyclist – experienced cyclists base their identity on the activity. In the UK this is still a minority pursuit, so cyclists develop a specific identity, linked to their enjoyment of cycling and their ability to overcome barriers to the activity.
- Linked to this is a sense of community and/or resistance ('We cyclists do it this way', 'Those car drivers don't understand'). This places emphasis on their right to cycle, which is as valid as other road users.
- Resilience and coping strategies – experienced cyclists develop strategies to deal with the challenges, including: finding quiet routes, knowing all the back lanes and shortcuts, riding defensively and assessing risk realistically. This coping strategy reflected a finding that some cyclists can overcome various barriers to the activity.
- Seeing the benefits – keen cyclists stress the tangible benefits over driving, including: predictable journey times, ease of parking, reduced cost (especially if cycling enabled one or more cars to be sold) and the avoidance of traffic jams.

These findings on influences on cycling behaviour are in line with Jones et al's¹⁴ characterisation of types of cyclists:

- Resilient riders were participants who engaged with cycling throughout mid-to-late adulthood and were still cycling at the time of the study.
- Re-engaged riders were participants who started cycling again after a period of five years when cycling was either absent or had significantly diminished.
- Reluctant riders were participants whose cycling had been curtailed or absent in the last five years and who stated that they had no intention to resume.

Barriers to active travel

Cycling-specific barriers

Barriers to cycling came across very strongly in the review – much more so than barriers to walking. The principal barrier stated by participants was fear of motorised traffic and the perceived risk of being knocked off a bike on the road. People referred to heavy traffic, high-speed traffic and the negative attitudes of car drivers. Many participants simply said they would not cycle on the road or in traffic, sometimes saying that they lacked the confidence to do so and preferred off-road paths or even pavements. Some participants reported that this fear was exacerbated by the often negative behaviour of car drivers. This is coupled with what is seen as poor cycle infrastructure – characterised by the bike lane that is nothing more than a painted white line that starts and stops often just where it is needed most, such as at junctions.

The appeal of cycling as a mode of transport is also countered by our prevailing car culture in which the private car is the ‘normal’ mode of transport. As Pooley said, this ‘system of automobility’ restricts the development of alternative modes of transport and makes them psychologically less attractive to the travelling public¹⁰. This is very relevant to people aged 50-70. Such participants suggested that using the car had become habitual and was linked to lifestyle. In rural areas, the car was seen as essential to the extent that active travel was hardly mentioned other than through discussion of barriers to it.

As noted above, keen cyclists are able to overcome these barriers, but only because they put a stronger emphasis on the benefits of cycling. Interestingly, there were also several sub-themes among several interviewees reported in the studies. First, that people were cycling because it is their right to do so and people driving cars were not going to stop them. Second – and the focus of one of the papers¹³ – a group of active travel commuters in Cambridge, most of whom cycled, reported cycling despite a hostile environment which constituted their commuting route. The authors referred to the term ‘journey literacy’ to describe how active travellers had become savvy street users in knowing the routes that took them away from heavily motorised traffic, even if it added to journey times. E-bikes are likely to help this, particularly for people facing reduced physical capacity (or distance) or complex travel patterns that makes conventional cycling more challenging¹⁹.

General active travel barriers

Participants said there were a number of barriers to walking and cycling for transport:

- **Lack of motivation:** this is likely to be the most important barrier, but few participants in the review actually admit to this, saying instead they lack the time, or have too far to travel, but this covers a more complex weighing up of the pros and cons.
- **Distance:** the journeys required are deemed too far to walk or cycle.
- **Weather:** some participants said they would not walk or cycle when it was too cold or wet.
- **Personal safety:** people felt safer to be in a car than on the street.
- **Lack of an active travel habit:** active travel had not continued or had not been re-engaged with after a period of absence.
- **Physical barriers, including declining health and/or disability:** one study found that people aged 50 and over and/or those with a disability are less likely to regard walking or cycling as viable alternatives to short car journeys.

However, these points need to be set in the context of a prevailing car-centric transport culture in the UK. Policy and planning has supported the private car for the last 40+ years, resulting in a built environment that rewards car travel and penalises walking and cycling. This weighs heavily on any personal decisions that people might make when considering active travel over the car.

As noted, there was greater focus in the research on cycling rather than walking. In addition, despite clear international evidence regarding the value of public transport in increasing active travel use and minutes of physical activity, especially walking, the studies addressing public transport that were considered for inclusion largely did not address the active travel parts of the journey nor user reflections on active travel. Instead, the focus was on the intrinsic social value of bus use in getting out and talking with others. Similarly, there was almost no discussion of people aged 50-70 who are mobility-impaired. This may be a reflection of the fact that this age group is just not a focus of research, so issues of mobility are contained much more in studies of older people's travel behaviours.

Summary

Active travel – general	
Motivators and enablers	Barriers
<ul style="list-style-type: none"> - Health benefits of physical activity - Mental health benefits (relaxation and stress reduction) - Enjoyment of the outdoors – enjoying fresh air, being in the community and seeing what’s going on - Feeling independent and in control - Preparing for an active retirement - Changes in personal circumstances, such as moving home or changes in employment 	<ul style="list-style-type: none"> - Distances too great in rural areas - Lack of motivation/lack of priority - Weather - Personal safety or feeling unsafe - Lack of an active travel habit - Declining health or disability

Active travel – cycling-specific	
Motivators and enablers	Barriers
<ul style="list-style-type: none"> - Having cycled in earlier life - Feeling an identity as a cyclist and part of the cycling community - Understanding and valuing the tangible benefits of cycling, such as predictable journey times and no traffic jams - Developing resilience and coping strategies to overcome unsupportive cycling environments 	<ul style="list-style-type: none"> - Fear of motorised traffic - Lack of confidence - Poor cycle infrastructure - Prevailing car culture, including poor driver behaviour

Which of these issues may be more important among the 50-70 year old participants, compared to other ages?

Finally, some of the factors that may be particularly pertinent to the 50-70 year age group are presented. It is important to point out that this is subjective, based purely on the reviewers' knowledge of the general active travel literature (as this was not reviewed for this report). It is of note that most of the eight bullet points do feature in the review findings as summarised above.

Motivators

- Reducing the impact of existing health conditions
- A particular focus on mental health and stress reduction
- Enjoyment of the outdoors
- Preparing for an active retirement, notably through a resolution to walk more. In a tiny minority of cases that may mean buying a bike (if a lapsed cyclist) or an e-bike (if a cyclist who is finding cycling difficult due to health)

Barriers

- Stability of lifestyle
- Lack of an active travel habit in earlier life
- Car travel is the norm (e.g. higher than among young people)
- Rural location making journey distances too great

Comments on the review methods and findings

This review has provided a unique insight into views of active travel from 50-70 year old participants in research studies conducted in the UK. It has outlined some of the key motivators and barriers related to active transport. The reviewers faced a number of challenges, the main one being that the 50-70 year age group is not commonly studied by researchers, so is difficult to find in the literature. Where papers focus on 'older people' or 'ageing' they generally consider people aged 65 and over. Data applicable to people aged 50-70 therefore had to be extracted from broader studies, meaning that in-house analysis had to be conducted, which made the review feel more like a new qualitative study of a very diverse sample of people drawn from 12 individual qualitative studies. The volume of data emerging from this process is small – while 12 full qualitative studies would usually allow quite a detailed understanding of the research, participants' perspectives were in some cases limited to only one or two quotes from individuals in the 50-70-year age bracket who had participated in a study. This can lead to the analysis of themes being quite tentative as it is not based on substantial data.

A related challenge was that a high proportion of researchers did not report the age of their participants at all. This seems surprising when age is such a key influence on physical activity and active travel. It may be excusable that individual quotes from participants were not linked to age (if the researchers were not investigating the impact of age in their study) but it is simply poor research practice not to describe the key demographic details of the research sample. Many studies which may have contained relevant data could not therefore be included in this review as there was no way to determine whether a participant aged 50 and over was in the 50-70 age group or exceeded it.

Gaps

Despite setting out to review studies looking into active travel – including wheeling (wheelchair use) – no studies of this topic among people aged 50-70 could be found. The result was the same for studies on active travel conducted among people aged 50-70 from minority ethnic communities, or among people with other protected characteristics. Nor was any analysis of attitudes to active travel segmented by socio-economic status discovered. Rural/urban differences were explored in some studies but no study covered this specifically.

Implications for future qualitative research

Overall, the review showed that there is a paucity of evidence on 50-70-year-olds' attitudes to active travel. This underlines the need for the research in general – this would certainly address a gap in the research evidence base. The review has shown that there is little evidence available on attitudes to active travel among minority ethnic adult populations, and disabled people – and certainly of those in the target age group. This could imply the need to over-sample these groups in the qualitative research. This review has revealed many interesting issues that can be explored in more detail in the qualitative research. These will be fed into the draft discussion guides.

Conclusions

Despite the challenges inherent in conducting this review, it has provided an interesting illumination of the challenges of encouraging people aged 50-70 in the UK to walk or cycle for short journeys. Walking is likely to be part of most able-bodied people's lived experiences, yet it is so commonplace and taken for granted that its reporting is often not considered as it is 'hidden in plain sight'. For cycling, there is a clearer picture because it is a minority activity undertaken

mainly by people identifying as keen cyclists. Those aged 50-70 who cycle by and large did so despite barriers to the activity and had often adopted tactics such as finding relatively safe and more pleasant routes away from heavily motorised traffic streets.

This review provides strong justification for conducting primary research among people aged 50-70 in the UK. This will help to fill the research gap in this area, and also allow more detailed and focused investigation of specific issues highlighted above. It also provides more general guidance for policymakers interested in increasing participation in active travel, offering an insight into motivations, attitudes and habit, as well as the critical interactions between these and aspects of the physical environment.

Appendix A. Details of included studies

Author	Publication date	Citation	Category	Study description
Jones, H et al	2014	A biographical approach to studying individual change and continuity in walking and cycling over the life course, <i>Journal of Transport & Health</i> , 1: 182-189.	Peer-reviewed	Biographical interviews supported by a life history calendar were developed and conducted with two adult birth cohorts.
Jones, T, Harms, L, Heinen, E	2016	Motives, perceptions and experiences of electric bicycle owners and implications for health, wellbeing and mobility, <i>Journal of Transport Geography</i> , 53: 41-49	Peer-reviewed	Draws on evidence from interviews with e-bike owners.
Jones, T et al	2017	Cycling beyond your sixties: the role of cycling in later life and how it can be supported and promoted.	Book Chapter	Following the biographical interview, those people who did not cycle took no further part in the study. Participants who currently cycled were invited to take part in a mobile observation.
Graham, H et al	2020	Older people's experiences of everyday travel in the urban environment: a thematic synthesis of qualitative studies in the United Kingdom, <i>Ageing & Society</i> , 40: 842-868.	Peer-reviewed	Conducted a qualitative evidence synthesis of United Kingdom-based studies of older people's experiences of travelling in the urban environment.
Graham, H et al	2018	The experiences of everyday travel for older people in rural areas: A systematic review of UK qualitative studies.	Peer-reviewed	A systematic review of qualitative studies to understand more about their experiences of everyday travel.
Guell, C, Panter, J, Ogilvie, D	2013	Walking and cycling to work despite reporting an unsupportive environment: insights from a mixed-method exploration of counterintuitive findings.	Peer-reviewed	Participants were included in this analysis if they reported unsupportive conditions for walking or cycling on their route (e.g. heavy traffic) in questionnaires, walked or cycled all or part of the journey to work, and completed qualitative interviews.
Jones, H	2013	Jones, H. 2013. Understanding walking and cycling. using a life course perspective. A THESIS	Peer-reviewed	Biographical interviews. Thesis presents a study of the change and continuity in individual behaviour over the life course as well as inter-generational influence of, and inter-cohort similarities and differences in, behavioural pathways.

Appendix A. Details of included studies

Author	Publication date	Citation	Category	Study description
Pooley, C, Horton, D, Scheldeman, G, Harrison, R	2010	Shaping the City for Walking and Cycling: A Case Study of Lancaster, Built Environment, 36(4): 447-460.	Peer-reviewed	In-depth interviews in Lancaster with residents who walked and or cycled regularly.
Jones, C, Ogilvie, D	2012	Motivations for active commuting: a qualitative investigation of the period of home or work relocation, Journal of Behavioral Nutrition and Physical Activity 2012, 9: 109.	Peer-reviewed	This qualitative study aimed to explore experiences and motivations regarding travel behaviour around the period of relocation, in an effort to understand how active commuting might be promoted more effectively.
Cavill N, Watkins F	2007	Cycling and health. An exploratory study of views about cycling in an area of North Liverpool, UK	Peer-reviewed	Following a literature review, qualitative focus group research was conducted among six groups of children, single mothers and older people living near the Loop Line.
Department for Transport (DfT)	2010	Road Safety Web Publication No. 17. Cycling, Safety and Sharing the Road: Qualitative Research with Cyclists and Other Road Users.	Grey – qualitative	Qualitative research carried out with cyclists and other road users (ORUs) as part of the wider research programme, Road User Safety and Cycling, being led by TRL on behalf of the Department for Transport.
Transport for London (TfL)	2016	TfL. Older Londoners’ perceptions of London streets and the public realm.	Grey – qualitative	Desk research; 20 accompanied journeys and 3 focus groups with people aged 65 and over.
DfT	2017	Disabled people’s travel behaviour and attitudes to travel.	Grey – qualitative	Aims to begin to address gaps in the evidence base on the travel behaviour of people with disabilities, drawing on recent secondary analysis of five key surveys.
TfL	2015	Attitudes towards walking in London.	Grey – qualitative	This report presents findings from 1,000 interviews conducted by telephone with a random sample of Londoners in March and April 2015.
Greater Sport	2020	Active Travel and Older Adults.	Grey – qualitative	Very limited data from TfGM's their segmentation survey - which is not publicly available.

Part 4.

Role of the built environment

This part of the report sets out the purpose and methods of a second evidence review on the role of the built environment, active travel and people in mid-life. This is followed by detailed findings which then draw out key themes before the findings are discussed and their implications considered.

Purpose and methods

Research Questions

This review set out to answer two main research questions:

- What role does the built environment play in encouraging or discouraging active travel for those aged 50-70?
- What are the characteristics of the places where participation in active travel is high?

Review inclusion criteria

The definitions and criteria used to cover the types of evidence that were to be included in the review are set out below:

Active Transport

Walking and cycling carried out for the purposes of transport (at any intensity or speed). Walking and cycling for leisure purposes are excluded from this review.

Populations under study

The findings of this review are intended to be applied to adults aged 50-70. However, an age criterion was not applied, including papers that studied environments and adults of any age instead. This is for two main reasons. First, there are few (if any) studies looking into the environment for active travel in this age group. Second, international evidence and National Institute for Health and Care Excellence (NICE) guidance in this field shows that active environments supporting active travel in adults are highly likely to be applicable to this age group (apart from specific modes of travel such as travel to school).²³

Study designs included

Due to the volume and quality of available evidence, the focus of this review was on meta-analyses and systematic reviews of studies that covered the environment and its relationship to active travel. Studies included in such systematic reviews are all quantitative in nature and could include intervention or cross-sectional studies (reporting correlates and determinants).

Publication status

Published in peer-reviewed academic journals in English.

Study designs to be excluded

- Single studies (i.e. not reviews)
- Studies of children or child or youth/school travel
- Narrative or non-systematic reviews and systematic reviews of qualitative studies

Dates

The volume and quality of studies available were such that the focus of this review could be placed on studies conducted in the last ten years (2010 to 2020).

Geography

Global.

Search terms

active travel; active transport; walk; pedestrian; bike; bicycle; environment, bike paths, bike routes, bike lanes, infrastructure; systematic review.

Review methods

Searching

Health, social science, age-related and transport-related databases were searched for studies published in English language journals. Databases included: Transport Research International Documentation (TRIDS), Medline, CINAHL Plus, Pubmed, Scopus and Google Scholar.

Search terms that included a combination of key words related to quantitative research methods, active travel and mid-life were used. References in previous studies which provided context were also checked. Additionally, an advisory group of leading researchers in the field of active travel, transport and physical activity was convened to check the identified studies for completeness.

Screening

Reviewers screened records by title and abstract to identify studies published in peer-reviewed journals, retrieved the full texts of journal papers and the two principal authors were then screened to determine eligibility for inclusion. Any discrepancies were discussed and agreed by consensus.

Data extraction and quality appraisal

Both reviewers undertook data extraction and cross-checked each other using a standardised data extraction form covering aims, study details, study design, analytical methods and key results. They assessed study quality using a standard framework which covers a range of domains, including methods, data analysis and ethics. Both reviewers undertook quality appraisal and discussed any issues and agreed amendments where appropriate. A number of papers were discussed and this resolved an issue where a study initially identified for exclusion was included.

Results of literature searches, and data extraction

Peer reviewed search engines

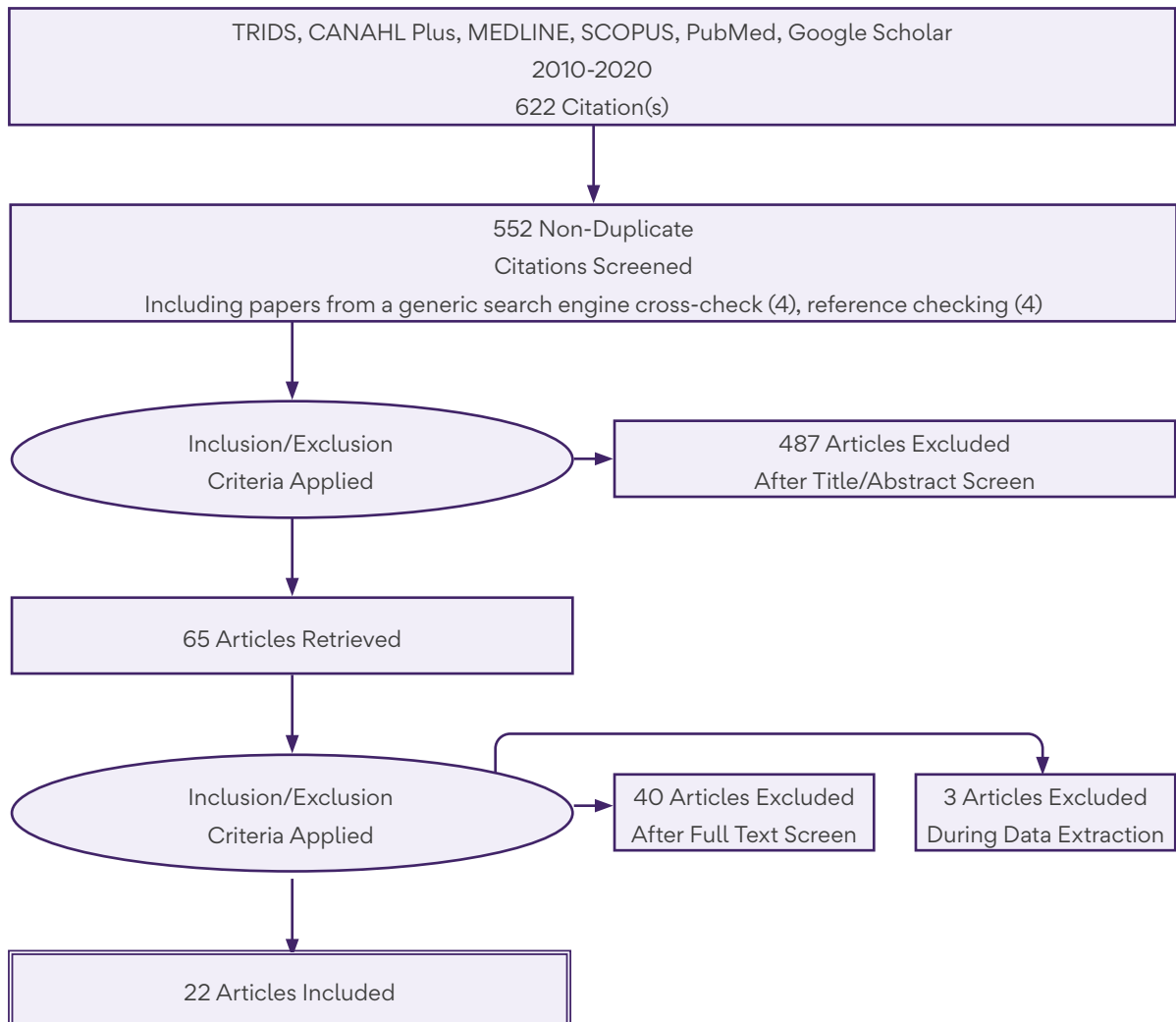
Reviewers found (Figure 1) 622 papers through searches of the peer-reviewed literature and after removing duplicates, leaving 552 remaining as follows:

- TRIDS: 67 papers
- CINAHL Plus: nine papers
- Medline: 39 papers
- Scopus: 34 papers
- PubMed: 94 papers
- Google Scholar: c. 300 papers

Five papers from a generic search engine cross-check and four through reference checking were also identified. Of the 552 papers, 65 were assessed by obtaining full papers. In total, 22 peer-reviewed studies were included. These were:

- Eight systematic reviews of intervention studies (longitudinal; pre-post; RCTs and uncontrolled)
- Three meta-analyses of studies using a cross-sectional study design
- 11 systematic reviews of cross-sectional / observational studies

Figure 1. PRISMA flow chart of search strategy and study selection.



The included studies were grouped, with the most robust study designs first.

Intervention studies provide much stronger evidence than correlational ones, which can only describe the extent to which aspects of the environment are associated with behavioural outcomes. Studies with a longitudinal study design overcome potential bias by measuring walking and cycling before and after some form of change to the environment. Correlate studies suffer from greater potential bias as it is not possible to establish any causality. For example, it may be possible that people who like walking choose to live in a walkable environment, rather than the environment encourages them to walk.

Cross-sectional studies provide weaker evidence of the relationships between aspects of the environment and walking and cycling. However as they are relatively easy to conduct, cross-sectional studies have the advantage of being able to measure very specific aspects of the environment at a point in time. A strong body of literature has developed in the last 10 years with many studies using consistent measures. It means that researchers have been able to conduct meta-analyses of the correlation studies. These are the most reliable types of review – rather than compiling and discussing the results of numerous studies, meta-analyses combine the results of each study into a new analysis. Meta-analyses therefore provide a very reliable and accessible summary of the correlates literature.

In each discussion of the results, findings from the eight intervention studies are presented first (Table 1, studies 1-8), followed by meta-analyses of the three cross-sectional studies (Table 1, studies 9-11), and then descriptive reviews of the 11 cross-sectional and observational studies (Table 1, studies 12-22). A comprehensive list of the included papers can be found in Appendix B (by study type, types of interventions and outcomes) and Appendix C (by key themes).

Table 1. Summary of the included studies graded by study type.

No.	Lead author (Year)	Title
Systematic Reviews: Intervention studies		
1	Ding D, et al (2018)	Moving to an active lifestyle? A systematic review of the effects of residential relocation on walking, physical activity and travel behaviour.
2	Foster C, et al (2018)	What works to promote walking at the population level? A systematic review.
3	Kärmeniemi M (2018)	The Built Environment as a Determinant of Physical Activity: A Systematic Review of Longitudinal Studies and Natural Experiments.
4	Mölenberg F (2019)	A systematic review of the effect of infrastructural interventions to promote cycling: strengthening causal inference from observational data.
5	Panter J (2019)	Can changing the physical environment promote walking and cycling? A systematic review of what works and how.
6	Smith M (2017)	Systematic literature review of built environment effects on physical activity and active transport – an update and new findings on health equity.
7	Stappers N (2018)	The effect of infrastructural changes in the built environment on physical activity, active transportation and sedentary behavior – A systematic review.
8	Stewart G (2015)	What interventions increase commuter cycling? A systematic review.
Meta analyses of cross-sectional studies		
9	Barnett D (2017)	Built environmental correlates of older adults' total physical activity and walking: a systematic review and meta-analysis.
10	Cerin E (2017)	The neighbourhood physical environment and active travel in older adults: a systematic review and meta-analysis.
11	Ewing R (2010)	Travel and the Built Environment: A Synthesis.

Descriptive reviews of cross-sectional studies/ observational studies		
12	Durand CP (2011)	A systematic review of built environment factors related to physical activity and obesity risk: implications for smart growth urban planning.
13	Farkas B (2019)	Evidence synthesis – A systematized literature review on the associations between neighbourhood built characteristics and walking among Canadian adults.
14	Fraser SD (2010)	Cycling for transport and public health: a systematic review of the effect of the environment on cycling.
15	Grasser G (2013)	Objectively measured walkability and active transport and weight-related outcomes in adults: a systematic review.
16	Hilland TA (2020)	Correlates of walking among disadvantaged groups: A systematic review.
17	Lin C-Y (2020)	Workplace neighbourhood built environment and workers' physically-active and sedentary behaviour: a systematic review of observational studies.
18	McCormack GR (2011)	In search of causality: a systematic review of the relationship between the built environment and physical activity among adults.
19	Rosso AL (2011)	The Urban Built Environment and Mobility in Older Adults: A Comprehensive Review.
20	Van Holle V (2012)	Relationship between the physical environment and different domains of physical activity in European adults: a systematic review.
21	Van Cauwenberg J (2011)	Relationship between the physical environment and physical activity in older adults: a systematic review.
22	Yun HY (2019)	Environmental Factors Associated with Older Adult's Walking Behaviors: A Systematic Review of Quantitative Studies.

Where the countries are stated in the individual studies included in each of these reviews we have included that information. We have also noted how many of the individual studies were conducted in the UK.

Detailed findings

Systematic reviews of intervention studies

Eight papers presented the results of systematic reviews of studies that used some form of longitudinal study design, measuring the impact of an ‘intervention’ or change to aspects of the environment on measures of walking and/or cycling. In most cases these are natural experiments (i.e. where an environmental change was planned and researchers measured its impact). In the strongest study design these measures were compared to a control or comparison area.

Kärmeniemi et al (2018)²⁴ conducted a systematic review of longitudinal studies and natural experiments of changes in the built environment and their impact on physical activity (including transport-related walking and cycling). The study population consisted of adults in 35 studies, children and adolescents in six studies and elderly people in two studies – eight studies did not use age restrictions. All of the studies were conducted from 2003 to 2015 in high-income economies (28 in North America, 11 in Europe – of which seven were from the UK – nine in Australia, two in Asia and one in New Zealand). The authors presented their findings by type of intervention.

New Infrastructure for Walking, Cycling, and Public Transport

Of the 16 natural experiments, a change in walking, cycling or public transport infrastructure was associated with increased physical activity in nine studies and decreased physical activity in one study. The majority of these studies assessed new routes for walking and cycling. The most robust evidence was found for overall and transport-related increases in physical activity.

Accessibility

Accessibility to destinations was associated with increased physical activity in eight studies and decreased physical activity in one study. For example, one study was of Australian adults who had relocated to a new housing development designed according to Liveable Neighbourhoods Guidelines. For each objectively measured transport-related destination (distance from home) there was an associated increase in walking by 5.8 minutes per week after relocation. For each recreational destination there was an increase in walking by 17.6 minutes per week after relocation. Among the same study population, an increase in the total number of destinations and land use mix were related to more walking for transport.

Street Network Characteristics

Improved street connectivity was associated with increased physical activity in five studies and decreased physical activity in two studies. For example, one study of American women found moving to an area with fewer cul-de-sacs was associated with 757 more daily steps. Increased exposure to pedestrian network intersections (with increased destination choice) was associated with increased walking distance.

Density

In areas of higher housing density, women walked for transport over twice as much as in the least-dense areas. Moreover, women who moved to less-dense neighbourhoods were 36% more likely to report reduced levels of transport walking. An increase in population density was also associated with a 3.8% increase in walking trips and 1.54 times higher odds in the uptake of transport-related cycling.

Aesthetics

A higher sense of aesthetics was associated with improved physical activity in all four of the studies that assessed the pleasantness and positive features of neighbourhoods. For example in one study, men whose perception of the neighbourhood's aesthetics increased following environmental changes were 2.25 times more likely to increase their overall levels of walking compared to those who did not change their perception. Another study revealed that each additional feature that was perceived to have changed the pleasantness of neighbourhoods favourably was associated with increased walking for transport by 3.0 min/week and increased recreational walking by 2.2 min/week.

Convenience

An Australian study found that if participants perceived greater convenience of walking opportunities in their neighbourhood they were twice as likely to increase walking.

Also the provision of a new bike lane was associated with an increase in the average number of cyclists from 79.2 to 257 per day on an intervention street, whereas on the adjacent control streets the number of cyclists decreased from 54.4 to 36.3.

The authors of this review concluded that improved, objectively measured accessibility of different types of destination and public transport and land use mix were associated with increased physical activity. Creating new infrastructure for walking, cycling and public transport could induce demand for walking and cycling. The results support the creation of compact and diverse residential areas and investments in infrastructure that encourage active modes of transport.

Panter et al (2019)²⁵ conducted a systematic review of how changing the physical environment can promote walking and cycling. This review included 13 intervention studies, most of which focused on walking and cycling for transport. They found three common approaches that interventions take to promote walking and cycling:

- improving accessibility and connectivity
- improving traffic and personal safety
- improving the experience of walking and cycling

The most effective interventions were those that improved accessibility and safety. The researchers differentiated between supportive and unsupportive contexts i.e. environments that may or may not be amenable to active travel. In terms of accessibility, both supportive and unsupportive conditions for walking and cycling could trigger increases in walking and cycling. For example, in physical contexts that were already supportive for walking and cycling – such as areas with many destinations and employment centres in easy reach and with good public transport links – cycling might have become even more practical for short trips. In the context of an unsupportive environment, such as an area with a fragmented cycle network, new infrastructure may also make it more convenient to cycle than to use a car, resulting in similar overall increases in the number of cycling trips and time spent cycling. For those without access to a car or those commuting, the new infrastructure might have led to cycling becoming a more convenient or a viable alternative to walking and was cheaper than public transport. In terms of improving connectivity, making better connections to destinations appeared to make it more convenient to walk or cycle. Where the infrastructure was well-used, increases in overall walking and cycling were reported.

For traffic and personal safety, comprehensive and connected walking and cycling networks did not simply enhance convenience or accessibility, they also provided the opportunity for safe routes without hazardous incursions by motor vehicles or reduced the perceptions of crime. Traffic safety for active travelers depends in part on segregation from motor vehicles. In the context of busy, car-dominated urban environments with fast-moving traffic flows, infrastructure that segregated pedestrians and cyclists from motor vehicles appeared to alleviate concerns about traffic safety and reduce the conflict between motorists and cyclists.

With regard to improving the experience of walking and cycling, the researchers noted that new walking and cycling paths may have alleviated concerns about personal safety by providing well-lit places for walking and cycling, subsequently encouraging the use of new infrastructure. However, if these spaces or routes were subsequently used as a location for criminal activities then the perception of risk may have increased, and this might result in low usage of infrastructure. For example, users might still have to cross busy roads to reach new infrastructure. Provision of an off-road path might reduce conflict between cyclists/pedestrians and motorised traffic in some parts of a journey but not all, and this might be particularly important for those who do not already walk or cycle. However, there was little information about potential mechanisms. The most plausible mechanisms concerned improving accessibility and convenience of walking and cycling and reducing potential conflict between users.

Stappers et al (2018)²⁶ conducted a systematic review of the effect of infrastructural changes in the built environment on physical activity, active transportation and sedentary behavior. This included 19 quasi-experimental and natural experiments, most of which addressed active travel. Overall, on and off-road cycling and walking trails resulted in inconsistent effects on overall physical activity and walking and

predominantly positive effects on bicycling. More extensive built environment infrastructure changes (such as the implementation of a bus lane with parallel walking and bicycling trail and traffic-free bridges) led to mixed results, with mainly non-significant effects. However, positive effects on cycling as a form of active travel were found for people living closer to areas that had seen changes e.g. within two miles.

Single on and off-road cycling and/or walking trails were found to result in inconsistent effects on physical activity and walking in two of seven studies, but predominantly positive effects on cycling in seven of 11 studies. When taking proximity to the intervention into account, four out of four studies showed cycling seemed to increase after environmental changes. The effectiveness of environmental changes varied greatly across intervention types – not all infrastructural interventions resulted in positive effects for physical activity and/or active travel. Studies specifically targeting physical activity and small interventions showed more effects than those evaluating the impact of more major infrastructural changes, such as the construction of traffic-free bridges.

The authors of the review note that it is important to bear in mind the impact on the findings of both the magnitude and the quality of the intervention under evaluation. The magnitude of the built environment infrastructural changes varied between studies. On and off-road bicycling and/or walking trails are relatively small interventions specifically targeting the promotion of physical activity and active travel. On the other hand, more extensive interventions typically imply major changes to whole (i.e. infrastructural) systems. This systematic review found that built environment infrastructural changes can lead to changes in overall physical activity and active travel, with better results for bicycling rather than walking. However, the current state of evidence is inconclusive. Improved understanding of the potential of built environment infrastructural changes to increase physical activity levels – and decrease sedentary behaviour – at population level requires more high-quality, in-depth evaluation that takes into account the broader transport system in which the intervention takes place.

Stewart et al (2015)²⁷ conducted a systematic review of the types of interventions that increase commuter cycling. This comprised a total of 12 studies: six were from the UK, two from Australia and one each from Sweden, Ireland, New Zealand and the USA. Of those, two studies were randomised control trials (RCT) and the remainder were pre-intervention and post-intervention studies.

Five environmental interventions had small but positive effects. The opening of a bridge exclusively for walking and cycling over an inner-city motorway in Glasgow was associated with a 47.5% increase in the number of cyclists entering the city centre from the south with almost no change in numbers of cyclists crossing other bridges. The evaluation of the England-only Cycle Cities and Towns (CCTs) compared the towns with recent infrastructure interventions,

including new segregated routes, on-highway lanes and increased secure cycle parking, with matched towns. It reported that cycling to work in the intervention towns increased by 0.69 percentage points compared with matched control towns. This represented a significant increase relative to all three comparison groups. Monitoring at two-year follow-up found that proximity to the infrastructure was helpful: 18% of residents living within 5 km of the respective infrastructure change who knew about the infrastructure reported transport cycling, compared with 7% of the full sample.

In Ireland, census data indicated that cycle modal share fell from 6% in 1996 to 4% in 2002 and 2006 but had risen to 5% in 2011. In Dublin, commuter cycling was hypothesised to result from financial incentives (tax-free loans to purchase cycles), infrastructure change (traffic calming, cycle lanes including segregated lanes), promotional events such as Bike Week (family rides, removing traffic from streets, repair clinics and promotion talks), a shared bike scheme and publication of the first design standards for cycling in Ireland. Cycle modal share rose from 4% in 2006 to 6% by 2011. In Cork, cycle modal share fell from 2% in 1996 to 1% in 2002 and subsequent years, whereas in Galway it fell from 3% in 1996 to 2% in 2002. However, it is not clear the extent to which the 2008 financial crisis might have influenced the results.

The cycle commuter modal share increased from 2.8% to 3.3% in central Minnesota at the University of Minnesota (n=4855) and in Minneapolis (from 0.788 to 0.841, n=21 111) where cycle facilities had been implemented or improved, compared with the suburbs where cycle commute share fell (0.335% to 0.279%).

Ding Ding et al (2018)²⁸ conducted a systematic review of the effects of moving home on walking, physical activity and travel behaviour. Studies on moving home overcome the methodological limitations of cross-sectional studies as they explore the walking, physical activity and travel behaviours before and after people relocate between neighbourhoods that differ in environmental attributes. They reviewed 15 longitudinal prospective studies and eight retrospective longitudinal/quasi-longitudinal studies.

Among the eight retrospective longitudinal studies, they found good evidence for the relationship between residential relocation and walking (consistency score (CS)>90%). For the 15 prospective longitudinal studies, the evidence for the effects of environmental change or relocation on physical activity or walking was weak to moderate (CS mostly <45%), and even weaker for the effects on other outcomes, including physical activity, cycling, public transport use and driving. The most frequently studied environmental attributes in this review were overall transport access, social environment, crime-related safety and accessibility. The most examined environmental attributes were land use mix/destinations and public transport access/services, and the most commonly used outcomes were transport walking and cycling.

Overall there was consistent support for the effects of change in neighbourhood environmental attributes through residential relocation, particularly walking. Most environmental attributes (including land use mix/destinations, overall accessibility as well as transport access) yielded a positive consistency score of $\geq 50\%$ across outcomes and the score was particularly high for overall transport access (access to a range of specific or non-specific transport options, such as pavements, bike paths, public transport and roads), aesthetics and crime-related safety.

Foster et al (2018)²⁹ conducted a systematic review of what works to promote walking at the population level. This included pre-experimental and post-experimental studies of three approaches – mass media, community initiatives and environmental change. Of the studies included, 11 of 12 came from high-income countries (six from the USA, two from the UK and one each from Canada, the Netherlands and Belgium), with only one study from an upper middle-income country (Brazil). The construction of new environmental infrastructure on walking was evaluated by four recent studies. Goodman et al reported the effects of new cycle and walking infrastructure in three UK cities. They reported that walking for transport and walking for recreation had not increased 12 months later, with only walking for transport significantly increasing after 24 months of follow-up (8.8 min/week – 95% CI 2.8 to 14.8). Panter et al reported the impact of a new guided bus service and new walking and cycle routes on the residents of the environs of Cambridge, UK. They reported a non-significant increase in mean walking for commuting for residents who increased walking (mean 73.4 (SD 66.6), RR 0.90 (0.69 to 1.19)) with a graded exposure to a guided busway in Cambridgeshire (physically separated from other modes). The authors concluded that while there is evidence to support the role of environmental change in promoting walking, this is more effective if combined with mass media and community initiatives.

Mölenberg et al (2019)³⁰ conducted a systematic review of the effect of infrastructural interventions to promote cycling such as the opening of cycling lanes or the expansion of a city-wide cycling network. They reviewed 31 studies of cycling, with most studies focusing on functional and daily cycling. Studies were drawn from 11 countries, with just over half from the US and seven from the UK. Most of the evaluations found changes as a result of the intervention with the number of cyclists using the infrastructure facilities (including a major bridge improvement) increasing (median relative change compared to baseline: 62%, range: 4 to 438%) and to a lesser extent that existing cyclists cycled more (median relative change compared to baseline: 22%, range: -21 to 262%). Seven studies provided information on physical activity behaviour change and findings were mixed. However, overall, the authors concluded that introducing cycling facilities in cities is likely to increase the number of cyclists using the facilities and may result in increases in cycling including some new users.

Smith et al (2017)³¹ conducted a systematic review of the built environment effects on physical activity and active transport. In total 28 articles met the inclusion criteria for this review. The majority of studies were controlled repeat cross-sectional examinations (n=8), followed by uncontrolled repeat cross-sectional studies and uncontrolled longitudinal studies (both n=6). Almost three-quarters – 20 (71%) of studies were conducted in the USA, with the remainder from Australia (4) and Belgium, England, Scotland and New Zealand (all 1).

Findings suggested that the following factors show promise for increasing active transport in adults):

- multiple streetscape components for walking or cycling (including two or more of crosswalk and pavement improvements (such as gap closures, pavement widening, curbs and gutters), improved and covered bike parking, installation of traffic calming features (raised platforms, zebra crossings) and parking bays
- creating safe places to walk (e.g. because of newly installed streetlights and pavements)
- bike boulevard/lane installation
- new greenways (usually a shared-use path along a strip of land which may be a canal path or disused railway line)
- traffic free bridges and boardwalks
- temporary road closures and play equipment (which may be in a Play Street or park)
- access to and availability of public transport
- higher residential, destination and recreation density
- increased street connectivity
- increased land use mix

The authors concluded that the review adds strength to the evidence base for the positive impact of built environments on physical activity behaviours, active transport and visits to and use of activity settings. Improving neighbourhood walkability, the quality of parks and playgrounds and providing adequate active transport infrastructure is likely to generate positive impacts on activity in children and adults.

Meta-analyses of cross-sectional studies

Three reviews that had performed a meta-analysis of cross-sectional studies on aspects of the environment and their relationship to walking and cycling were found. Two of these studied older age groups, though it is important to note that these are among people aged aged 65 and over so are less directly relevant to the 50-70 age group of interest. Each of these studies will be described in turn, with the highest quality and most directly relevant reviews listed first.

Cerin et al, (2017)³² carried out a systematic review and meta-analysis drawing on 42 quantitative studies on active travel outcomes. Most studies reported findings from North America, followed by Europe, Asia, Oceania and South America. Africa was represented by a single study based on a small-scale pilot. Strong links between the neighbourhood physical environment and older adults' active travel (aged 65 and over) were reported. The researchers found very strong and consistent support for a positive association between objectively assessed neighbourhood walkability and older adults' total walking for transport. This relationship applied to older adults living in high as well as low-income neighbourhoods. Moderate-to-strong evidence of positive associations with total level of walking for transport also emerged for all individual components of walkability – namely residential density, street connectivity and land use mix. These three neighbourhood attributes were also identified as independent contributors to walking for transport in younger adults (aged 18-65 years) from 14 cities across the globe.

There were positive associations with total walking for transport in a range of categories: residential density/urbanisation, walkability, street connectivity, overall access to destinations/services, land use mix, pedestrian-friendly features and access to several types of destinations. There was a positive association of within-neighbourhood walking and pedestrian-friendly features and the availability of benches/sitting facilities. Correlates of all active travel categories combined mirrored those of walking for transport. There was, however, limited evidence available on correlates of cycling and combined walking and cycling for transport. Only two Belgian studies examined neighbourhood environmental correlates of cycling for transport in older adults. These studies examined a total of 12 environmental correlates. A large population sample provided evidence for positive relations with access to public transport and shops/commercial services and negative associations with urbanisation.

Barnett et al (2017)³³ conducted a systematic review and meta-analysis of the built environmental correlates of older adults' total physical activity and walking. Although this review seems particularly relevant, it is important to note that the authors defined older adults as being aged 65 and over. They included 100 studies of predominantly cross-sectional design. Regarding countries, the USA (36), Australia (13), the UK (10) and Canada (10) conducted the most research. They found strong evidence for total positive associations between older adults' walking and: neighbourhood walkability, access to and availability of shops or commercial destinations, overall destinations and services, and more greenery and aesthetically pleasing scenery. They also found evidence that access to and availability of neighbourhood public transport, parks/public open space, crime/personal safety, residential density, walk-friendly infrastructure and street lighting were positively associated with total walking. The authors concluded that safe, walkable and aesthetically pleasing neighbourhoods with access to overall and specific destinations and services positively influenced older adults' physical activity participation.

Ewing & Cervero (2010)³⁴ conducted a meta-analysis of 50 correlational studies where the main outcomes were walking and public transport use. Of these, 48 were from the US, one from Denmark and one from Germany. It draws on previous research that highlighted the central importance of what was termed the ‘D variables’: density, diversity and design, followed later by destination accessibility and distance to transit. Demand management, including parking supply and cost, is a sixth D and is included in a few studies. The meta-analysis found that walking is most strongly related to measures of land use diversity, intersection density and the number of destinations within walking distance. Mode share and likelihood of walk trips are most strongly associated with the design and diversity dimensions of built environments – especially intersection density, jobs-housing balance and distance to stores.

Reviews & cross-sectional studies/observational studies

We also identified 11 individual descriptive reviews of cross-sectional studies (or, in a small number of cases, where the study designs included were mixed but the majority were cross-sectional design). Of these, four were conducted since the most recent meta-analyses^{32,33} so will be described below and reviewed in case they contained any recent evidence for emerging correlates.

Hilland et al (2020)³⁵ conducted a systematic review of correlates of walking among disadvantaged groups. They found 9 studies looking into walking for transport. A third of studies were based in the USA (3), with others based in Australia (2), Belgium (2), the Netherlands (1) and Canada (1). They found that the factors influencing different types of walking may vary – perceived individual safety was the only factor that showed evidence of consistent associations with overall walking, leisure-time walking and walking for transport. They concluded that this supports the importance of examining the correlates of different domains of walking separately from each other.

Lin et al (2020)³⁶ conducted a systematic review of observational studies looking into the workplace neighbourhood built environment and workers’ physically active and sedentary behaviours. They found 55 studies in total, of which 44 concerned transport walking. Most of the studies were undertaken in the USA (25) and the UK (13), accounting for around 70% of all studies. They found that destination-related attributes, notably longer distances between workplace and home, as well as better access to car parking around the workplace, were positively associated with transport-related sedentary behaviour. The sedentary transport behaviour in all the reviewed studies was travelling by car. The review concluded that a short travelling distance to the workplace may make it more likely that workers undertake active commuting.

Yun et al (2019)³⁷ conducted a systematic review of environmental factors associated with older adults' walking behaviours. They found 14 studies of transport walking, none from the UK. Although this review seems particularly relevant to our own, it is important to note that the authors defined older adults as aged 70 years and over. They found a strong relationship between the walking behaviours of older adults and neighbourhood environment characteristics, though some evidence was still too weak to generalise the significance of environmental characteristics since the associations differ by walking types. They concluded that, compared to other types of walking, neighbourhood environmental factors are more important predictors of walking for transport among the elderly (aged 70+).

Among 90 moderation effects of socio-demographic, physical and psychosocial, and environmental factors, 40 interactions were positive and 15 interactions were negative (with statistical significance). Walking infrastructure and personal safety in males but not females, perceived presence of sitting facilities for both males and females, presence of street lighting and perceived crime safety in females but not males were significantly associated with transport walking. Land use mix-diversity (+) and presence of sitting facilities (+) were associated with walking among older seniors (≥ 75).

Farkas et al (2019)³⁸ conducted what they called a 'systematized' literature review on the associations between neighbourhood characteristics and walking among Canadian adults. They only looked at Canadian studies and found 14 studies looking into walking for transport. Overall walkability and land use were consistently associated with walking for transport. Proximity to destinations was associated with walking for any purpose and a positive association was found between personal safety and volume of transport walking. The most common functional characteristics examined included walkability, connectivity and population density.

The remaining seven studies are briefly described below. They are included for completeness, but in the majority of cases their findings will have been included in the stronger meta-analyses referred to above.^{32, 33, 34}

Grasser et al (2013)³⁹ conducted a systematic review of objectively measured walkability and active transport and weight-related outcomes in adults. They found 34 quantitative studies, 33 of which were of cross-sectional design. One study was from the UK. Most of the publications used weight-related measures as an outcome, while a minority used physical activity which are therefore limiting factors in that active travel was not an outcome. Walkability measures such as gross population density, intersection density and walkability indexes most consistently correlated with measures of physical activity for transport.

Walking for transport key variables were density (D), land-use mix (LUM), connectivity (C), walkability (W), cycling for transport (CfT) and overall active

transport (OAT). These variables are set out as bullet points:

- positive association between gross population density and walking (D)
- housing unit density was the strongest predictor of walking for transport (D)
- statistically significant but mainly minor correlations between housing unit density and walking for transport at different geographical scales (D)
- two out of four studies showed a positive association between land use and walking for transport (LUM)
- positive association between intersection density and walking (C)
- correlation between a composite measure of walkability and walking (W)
- significant positive associations between the walkability index (W)
- respondents in high-walkable areas walked 31 min per week more than respondents in low-walkable areas (W)
- positive associations between different composite measures and cycling for transport (CfT)
- positive association between cycling and the walkability index based on housing unit density, the entropy index and intersection density (CfT)
- residents of high-walkable areas were 1.8 times more likely to bike for transport than residents in low-walkable areas
- correlation between an increase in the walkability index and an increase in minutes of walking (OAT)

Durand et al (2010)⁴⁰ conducted a systematic review of built environment factors related to physical activity and obesity risk, with a focus on the implications for smart growth urban planning. They included 44 studies which had an active travel outcome. North America was the most frequent location, with 28 studies (25 in the USA and three in Canada), followed by Australia (nine) and Europe (five) of which two were from the UK. Five smart growth factors – diverse housing types, mixed land use, housing density, compact development patterns and levels of open space – were associated with increased levels of physical activity, primarily walking. However, in the detail, this review only suggested that several features of the built environment associated with smart growth planning might promote important forms of physical activity including active travel.

Fraser, Lock (2010)⁴¹ conducted a systematic review of cycling for transport and the public health effect of the environment on cycling. The 21 studies included were composed of experimental or observational types. Of these, 14 were from the US, three from Australia, two from the UK and one each from Canada and the Netherlands. The primary outcomes were cycling prevalence – the numbers of people cycling or the rates of people cycling, including active commuting or leisure cycling. An objectively measured environmental factor associated with higher rates of cycling that was statistically significant was identified in 11 studies.

Characteristics of neighbourhood environments formed the primary focus of seven of the studies. Environment themes included land use mix, urban form, population density, aesthetics, recreational facilities and transport environment.

Short trip distance, number of bikes in household, male gender, purpose of trip for recreation and (absence of) darkness were positively correlated with cycling, as were new cycle routes and density of bike lanes.

Van Holle et al (2012)⁴² conducted a systematic review of the relationship between the physical environment and different domains of physical activity in European adults (e.g. transport and recreation). This comprised 69 cross sectional studies and one longitudinal. The largest number of studies were conducted in the United Kingdom (19), Belgium (16) and the Netherlands (13). Transport physical activity appears to be more consistently related to the physical environment than for leisure. This study's summary results indicated convincing evidence for relationships with five environmental factors: walkability was positively related to total physical activity, transport walking and transport cycling, and access to shops, services or places of work was positively related to both general active transportation and transport cycling. Degree of urbanisation was positively related to transport cycling and negatively related to total physical activity. The presence and quality of walking and cycling facilities showed positive relationships with general active transport and cycling for transport.

McCormack & Shiell (2011)⁴³ conducted a systematic review of the relationship between the built environment and physical activity among adults. This comprised 13 quasi-experimental and 20 cross-sectional studies, the majority of which were undertaken in the US (29), with one each being conducted in Canada, Australia, the UK and the Netherlands. Eight studies reported on walking for transport and six on general cycling. A combination of commercial floor space, land use mix, residential density and connectivity were associated with increased walking trips. The built environment was more likely to be associated with transport walking compared with other types of physical activity, including recreational walking. Three studies found an attenuation in associations between built environment characteristics and physical activity after accounting for neighbourhood self-selection (i.e. the possibility that more active people may choose to live in more activity-friendly neighbourhoods).

Specific to transport, distance walked was found to increase as the distance between home and light rail transit increased. Second, the installation of an urban greenway/trail, was associated with increases in walking, cycling and other physical activity post-intervention. These results were supported by another study which found increases in daily bicycle traffic following the installation of cyclist infrastructure (i.e. cycle lanes, signage, marking, reductions in speed limits) as well as streetlighting. Several studies, however, have shown no association between pedestrian or cyclist infrastructure and physical activity. Third, walkability and neighbourhood type were positively associated with neighbourhood walkability.

Rosso et al (2011)⁴⁴ conducted a systematic review of the urban built environments and mobility and disability in adults aged 60 years and over. It specifically examined associations of objective measures of the built environment

with mobility. This comprised four longitudinal and 13 cross-sectional studies, with 16 studies from the US and one from Columbia. Twelve studies addressed the main outcome of walking. The existing literature suggests that mobility is associated with higher street connectivity leading to shorter pedestrian distances, street and traffic conditions such as safety measures, and proximity to destinations such as retail establishments, parks, and green spaces, though results have been inconsistent. Proximity to walking paths and trails was also associated with the total of daily walking but not with frequency of neighbourhood walking. These inconsistencies are likely due to differences in methodology.

In the detail of positive associations, higher housing density was associated with greater levels of walking and with less disability among those with lower body functional limitations. A positive association between walkability score and walking was found, but only among women.

Van Cauwenberg et al (2011)⁴⁵ conducted a systematic review of the relationship between the physical environment and physical activity in older adults, comprising three prospective and 28 cross-sectional studies. Of the 21 studies conducted in North America, seven were in the city of Portland (Oregon) and two were from the UK. The review reported a relationship between the physical environment and walking for transport. In terms of walkability, there was a positive relationship between objectively measured walkability and walking for transport and a positive relationship for a ‘new urbanism index’, including the presence of streets in a grid pattern, short blocks, facilities for a mix of uses but also pavements and street trees. The presence of shops in a street section was positively related to its use for transport walking. There was also an association between walking for transport and: the presence of a pavement (objectively measured), traffic volume, presence of dwellings located on the first floor and presence of front gardens.

Key themes

Introduction

This section draws out the main findings from this literature into key themes. This is clearly very challenging given the diverse literature and many different methodological approaches taken by both the original research studies and the systematic reviews. Our aim has been to use the best available evidence, so priority was given to findings from reviews of intervention studies. The features are described in priority order, with the strongest evidence first. This is also challenging, as many of the features of the built environment overlap and researchers take different approaches to classification or naming of features. The evidence for walking and cycling is presented separately to account for the differing evidence for each mode, but also to make it easier for readers who may have interest in one specific mode.

Walking

Walkability: Enhancing characteristics of the walking environment

The strongest evidence from intervention studies to increase walking comes from those that investigate improvements to the walking environment. This is a wide-ranging field, encompassing aspects of town planning, residential and retail design as well as pedestrianisation and other pedestrian or pedestrian-supporting facilities. The strong literature describing correlates of active travel (see below) has more recently been enhanced by intervention studies – usually natural experiments, which have found positive outcomes from making changes to the walking environment.

Key findings are that:

- Improved street connectivity was associated with increased physical activity in five studies and decreased physical activity in two studies.²⁴ For example, moving to an area with fewer cul-de-sacs was associated with 757 more daily steps in American women.²⁴
- Interventions that changed the environment to improve the experience of walking were effective, with the most effective appearing to target accessibility and safety.²⁵
- People who moved to an area with more a supportive walking environment, including overall transport access (such as access to pavements, bike paths, public transport and roads), a mix of land use, more destinations and better public transport access/services were likely to increase the amount they walked.²⁸
- Aspects of the built environment that increased walking included: pedestrian crossing and pavement improvements (such as gap closures, pavement widening, curbs and gutters), installation of traffic-calming features (raised platforms, zebra crossings), creating safe places to walk, temporary road closures and play equipment, access to and availability of public transport, higher residential, destination and recreation density, increased street connectivity and increased land use mix.³¹

The idea of ‘walkability’ has been extensively studied in the correlates literature. The three meta-analyses of correlate studies show high consistency in their findings:

- There was strong and consistent evidence for a positive association between neighbourhood walkability and older adults (65 and over) walking for transport. Moderate-to-strong evidence of positive associations with total walking for transport also emerged for all individual components of walkability: residential density, street connectivity and land use mix. These three neighbourhood attributes were also identified as independent contributors to walking for transport in adults (aged 18-65 years) from 14 cities across the globe.³²

- There was strong evidence for positive associations between older adults (65 and over) walking and neighbourhood walkability, access to/availability of shops/commercial destinations, overall destinations and services and more greenery and aesthetically pleasing scenery.³³
- Walking was most strongly related to measures of land use diversity, intersection density and the number of destinations within walking distance. The proportion of total trips undertaken on foot and likelihood of walk trips are most strongly associated with the design and diversity of built environments, especially intersection density, jobs-housing balance and distance to retail stores.³⁴

Similar findings were found in the systematic reviews:

- A strong relationship was found between the walking behaviours of older adults (70 and over) and neighbourhood environment characteristics.³⁷
 - Overall walkability and land use were consistently associated with walking for transport. Proximity to destinations was associated with walking for any purpose and a positive association was found between personal safety and volume of transport walking.³⁸
 - Walkability measures such as gross population density, intersection density and walkability indices were the most consistently correlated with walking and cycling for transport.^{39, 42}
 - Commercial floor space, land use mix, residential density and connectivity were associated with increased walking trips.⁴³
 - Walking for transport was associated with higher street connectivity (leading to shorter pedestrian distances), street and traffic conditions (such as safety measures) and proximity to destinations such as retail establishments, parks and green spaces.⁴⁴
 - There was a relationship between the physical environment and transport walking, notably a positive relationship between objectively measured walkability and transport walking and a positive relationship between walking and a 'new urbanism index' (including the presence of streets in a grid pattern, short blocks, facilities for a mix of uses but also pavements and street trees).⁴⁵
-

Density of the urban environment

A frequently studied aspect of the urban environment is urban density, for which there are various measures including population density, housing density and intersection density. In many ways, density is a proxy measure for destinations being close and accessible. This is usually studied in the correlates literature (as interventions to increase urban density are unlikely). However, there is some intervention-level evidence available:

- Women who moved to less-dense neighbourhoods were 36% more likely to report reduced levels of utilitarian walking. In contrast, an increase in population density was associated with a 3.8% increase in walking trips.²⁴
- A relationship was found between transport walking and higher densities of housing, destinations (e.g. shops) and recreation opportunities.³¹

As mentioned above, this issue is covered far more extensively in the correlates literature, with the three meta-analyses reporting similar findings:

- There is moderate-to-strong evidence of positive associations between total walking for transport and residential density.³²
- A relationship was found between walking and residential density.³³
- A relationship was reported between walking and intersection density.³⁴

These findings were repeated in the systematic reviews:

- There was a relationship between transport walking and population density.³⁸
- There was a positive association between gross population density and walking and a positive association between intersection density and walking.³⁹

Housing density was associated with increased levels of walking^{40, 43, 44}

Mix of land uses and accessible destinations

Another feature of a walkable environment is having a mix of land uses – notably housing mixed with retail and workplaces. This makes destinations closer and more accessible.

- Improved accessibility was associated with increased active travel. When people moved to a new housing development designed according to the Australian Livable Neighborhoods Guidelines with more everyday destinations within walking or cycling distance, they reported 5.8 minutes of additional

walking per week with every additional new destination. Perceptions were also shown to be important – if participants perceived greater convenience of walking opportunities in their neighbourhood they were twice as likely to increase walking.²⁴

- There was a relationship between walking and greater land use mix – which is thought to lead to more accessible destinations such as shops.³¹

In the meta-analyses of cross-sectional studies:

- There was moderate-to-strong evidence of positive associations between total walking for transport and access to destinations/services and land use mix.³²
- There was strong evidence for positive associations between older adults walking and access to/availability of shops/commercial destinations and overall destinations and services.³³
- Walking was found to be most strongly related to measures of land use diversity, intersection density and the number of destinations within walking distance.³⁴

In the single reviews:

- Land use mix-diversity and presence of sitting facilities were associated with transport walking among older people (≥ 75).³⁷
- Land use type was consistently associated with walking for transport.³⁸
- Access to shops/services/work was positively related to general active transportation.⁴²
- Land use mix, residential density and connectivity were associated with increased walking trips.⁴³

Safety

A key component of many approaches to increasing active travel through changes to the built environment is improving safety. This includes safety from traffic collisions as well as perceived safety from crime.

From the intervention studies:

- Comprehensive and connected pedestrian networks (i.e. connected paths) provide the opportunity for safe routes away from cars.²⁵
- Crime-related safety was associated with increased walking among people who relocated to a different environment.²⁸

- Creating safe places to walk was linked to more walking, along with traffic free bridges and boardwalks and temporary road closures.³¹

Safety was also related to walking in the correlates literature:

- In the meta-analyses, perceived individual safety was the only factor that showed a consistent association with overall walking, leisure-time walking and walking for transport.^{33, 35}
- A strong relationship was found between the walking behaviours of older adults and personal safety in males but not females, yet perceived safety from crime was related to walking for transport in females but not males.³⁷
- There was a positive association between personal safety and volume of transport walking.³⁸

Walking infrastructure

There is much less research on the impact of specific walking infrastructure on levels of walking than there is on the impact of cycling infrastructure on levels of cycling. This is because cycling is seen as requiring quite specific facilities, whereas walking takes place in a range of environments. However, there are still interventions that can take place to create more walkable places:

- There was evidence for the impact of new, high-quality, traffic-free routes for walking – the construction of new paths for walking led to walking for transport increasing by 8.8 minutes per week 24 months later.^{24, 29}

In the meta-analysis of cross-sectional studies:

- Walking-friendly infrastructure and street lighting were positively associated with total walking.³³

Aesthetics

Finally, some studies examined the relationship between walking and the aesthetics of the environment.

Evidence showed:

- A higher sense of aesthetics was associated with improved physical activity in all of the four studies that assessed the pleasantness and positive features of neighbourhoods. For example, following environmental changes, men who reported increased perception of aesthetics of the neighbourhood were 2.25 times more likely to increase their overall walking levels compared to those

whose perception of their neighbourhood had not changed.²⁴

- Each additional neighbourhood feature perceived to have changed favourably was associated with increased walking for transport by 3.0 minutes per week and increased recreational walking by 2.2 minutes per week.²⁴
- There was an increase in walking among people who moved to neighbourhoods scoring higher for aesthetics.²⁸
- There was an association between total walking and aesthetically pleasing scenery.³³

Cycling

Creating new infrastructure for cycling

There is evidence from reviews of intervention studies that creating infrastructure to support cycling – predominantly building new bike paths or bike lanes – leads to increases in cycling for transport. Most of these studies assessed new routes for cycling, often as part of intervention studies or ‘natural experiments’ (where some change was planned and researchers took the opportunity to measure the impact of those changes on behaviour).

- From 16 natural experiments, a change in infrastructure was associated with increased levels of cycling in nine studies and decreased levels of cycling in one study. The finding is stronger for cycling than for walking, as above.²⁴
- On and off-road cycling and/or walking trails resulted in inconsistent effects on overall active transport, physical activity and walking – and in predominantly positive effects on cycling, with stronger impacts among those living closer to the trails.²⁶
- The opening of a bridge for walking and cycling in Glasgow was associated with a 47.5% increase in the number of cyclists entering the city centre from the south, with almost no change in numbers of cyclists crossing other bridges.²⁷
- Of 31 studies of cycling interventions, the majority found changes in favour of the intervention, with an increase in the number of cyclists and, to a lesser extent, an increase in cycling behaviour (i.e. reporting doing more cycling).³⁰
- Increases in daily cycle traffic followed the installation of cyclist infrastructure.⁴³

This evidence is largely supported by the correlates literature:

- New cycle routes and density of bike lanes were correlated with levels of cycling.⁴¹
- The presence and quality of walking/cycling facilities were positively correlated with levels of active transport.⁴²

Improving the quality of the existing cycling environment

Alongside the evidence for cycle infrastructure, there is a closely related body of evidence to support improvements to the built environment to make cycling more convenient or accessible. These go beyond the simple building of cycle paths to include broader interventions such as improving accessibility, connectivity and safety. Evidence from intervention studies showed that improving the environment for cycling leads to increases in cycling (measured in a number of ways, including number of cyclists, number of trips and frequency of cycling):

One review highlighted the three types of improvements to cycle infrastructure that resulted in increased cycling:

- Improving accessibility to destinations and employment centres by bicycle, making cycling a more convenient or a viable alternative to walking and cheaper than public transport use.²⁵
- Improving connectivity and the continuity of a network or improving the directness of a route. Connecting destinations appeared to make it more convenient to walk or cycle and led to increases in overall walking and cycling.²⁵
- Reducing danger from traffic and increasing personal safety. Cycle networks provided the opportunity for safe routes (without hazardous incursions by motor vehicles) or reduced the perceptions of crime (by increasing on-street surveillance due to increased presence of cyclists).²⁵

Other reviews provided specific details of the relationships:

- Among people who had moved to different neighbourhoods, improved access to bike paths was related to increased levels of cycling for transport.²⁸
- Changes to existing cycle networks, such as the expansion of a city-wide cycling network, led to positive impacts on cycling.³⁰
- There was evidence for the positive impact of ‘multiple streetscape components’ for cycling, such as improved and covered bike parking, bike boulevard/lane installation, traffic-free bridges and boardwalks, temporary road closures and increased street connectivity.³¹

These findings are supported by the correlates literature:

- There were positive associations between different composite measures of the cycling environment and cycling for transport.³⁹
- Short trip distance, number of bikes in household, male gender, purpose of trip for recreation and absence of darkness were positively correlated with cycling, as was the density of bike lanes in an area.⁴¹
- Measures of ‘walkability’ were positively related to total cycling for transport, as were access to shops/services/work and the presence and quality of walking/cycling facilities.⁴²

Creating town or city-wide cycle networks

There is evidence from the intervention literature to suggest that cycle infrastructure can increase levels of cycling if implemented at scale across whole towns or cities. These are usually multi-component interventions, combining improvements to the built environment with campaigns and behavioural change activity. This makes it harder to disentangle the impact of any one element.

This evidence revealed that:

- Extensive interventions – including major changes to whole (infrastructural) systems – were shown to be more effective than single bike trails.²⁶
- UK Cycle Cities and Towns showed that cycling to work in towns that received widescale cycling improvements increased by 0.69 percentage points compared with matched control towns. Monitoring at two-year follow-up found that 18% of residents living within 5 km of an infrastructure improvement and who knew about the infrastructure reported increased transport cycling, compared with 7% of those who did not know about it.²⁷
- In Dublin, the percentage of cycle trips increased from 4% to 5% over five years following infrastructure change (traffic calming, cycle lanes including segregated lanes), alongside promotional events and financial incentives.²⁷
- In one US city, the cycle commuter modal share increased following improvements to cycle facilities.²⁷
- Increases in cycling followed the expansion of a city-wide cycling network.³⁰

Improving personal safety through separation from traffic

Many of the interventions above included the aim of making the environment safer for cyclists. A small number of reviews targeted this issue more specifically:

- A component of the successful intervention in Dublin included traffic calming and segregated cycle lanes.²⁷
- Higher levels of cycling (and walking) were reported among people who moved to neighbourhoods with better crime-related safety.²⁸
- There was a positive impact from cycle networks segregated from motor vehicles which appeared to alleviate concerns about traffic safety and reduce the conflict between motorists and cyclists.²⁵

Improving accessibility

There is evidence that the accessibility of destinations can make places easier to reach by bicycle. From the interventions literature:

- There were positive impacts on cycling among people who had moved to neighbourhoods with more accessible destinations.²⁸
- Cycling interventions that increase the accessibility of destinations were associated with increased cycling.²⁵

This issue has been studied more in the correlates literature:

- There was evidence from a large population sample for positive relationships between cycling and access to public transport and shops/commercial services.³²
- Short trip distance was positively correlated with cycling.⁴¹
- Access to shops/services/work was positively related to both general active transportation and transport cycling.⁴²

Population density

Residential and population density was shown to be an important element of walkability, but only one study provided evidence for the impact of density on cycling, reporting a 1.54-fold higher likelihood of taking up transport-related cycling among women who moved to neighbourhoods with a higher population density.²⁴

Table 2. Summary of strength of evidence for each of the key aspects of the environment on walking.

Environment themes	Examples	Evidence from intervention studies or natural experiments? ¹	Evidence from correlates studies? ²	Applicability to the UK? ³	Impact on specific population groups
Walkability	Improving the walking environment. Making streets more connected. Improving pavements and paths. Making destinations more accessible. Improving safety.	Good	Good	Moderate	Walkability and walking associated in people aged 65 and over.
Density	Making places more dense – meaning more destinations are accessible on foot.	Moderate	Good	Good	Women reported more walking in less dense neighbourhoods
Mixed land uses	Typically urban centres with housing near to shops and workplaces.	Good	Good	Good	Land use mix-diversity and presence of sitting facilities were associated with transport walking among older people (≥75).
Safety	Creating safe places to walk including protection from traffic. Also includes perceptions of crime-related safety.	Moderate	Moderate	Good	A strong relationship was found between the walking behaviours of older adults (aged 70 and over) and personal safety in males but not females, yet perceived safety from crime was related to walking for transport in older females but not males.
Walking infrastructure	Building specific walking infrastructure (e.g. footpaths).	Moderate	Moderate	Moderate	Much less research on the impact of specific walking infrastructure compared to cycling infrastructure. Yet where new walking for transport routes exist there are significant increases in walking.
Aesthetics	Making places more pleasant. Might include street design, painting, plants etc.	Moderate	Moderate	Moderate	Higher sense of aesthetics associated with improved physical activity, including transport walking, and among those aged 65 and over.

- 1 This is the strongest type of evidence as it measures the impact of changes to the environment on walking and cycling and compares it to areas where there were no changes. Good, Moderate, Weak are reviewers' assessment of the strength of this volume of evidence.
- 2 This type of evidence only shows that the aspect of the environment is related to levels of walking and cycling. This does not determine causality (for example, people who like walking may move to walkable neighbourhoods). Good, Moderate, Weak are reviewers' assessment of the strength of this volume of evidence.
- 3 Good, Moderate, Weak are reviewers' assessment of the extent to which this evidence can be applied to the UK, including the proportion of evidence that comes from UK studies.

Table 3. Summary of strength of evidence for each of the key aspects of the environment on cycling.

Environment themes	Examples	Evidence from intervention studies or natural experiments? ¹	Evidence from correlates studies? ²	Applicability to the UK? ³	Impact on specific population groups
Cycle infrastructure	Building new bike lanes and paths, installing features e.g. advanced stop lines, bike crossings and traffic-free bridges	Good	Good	High	Limited evidence addressing specific groups but notable focus on commute cycling.
Improving the quality of the cycling environment	Improving cycling connections to destinations e.g. work, improving directness e.g. making routes shorter, reducing danger from traffic e.g. separating from traffic.	Good	Good	High	Correlates studies show males more likely to cycle.
Creating town or city-wide cycle networks	Improvements for cycling implemented at scale across whole towns or cities.	Good	Good	High	
Improving personal safety through separation from traffic	As above, but specifically creating bike routes away from traffic.	Moderate	Moderate	High	
Improving accessibility	Making places easier to reach by bicycle.	Moderate	Moderate	Moderate	
Population density	Making places more dense – meaning more destinations are accessible by bicycle.	Weak	No evidence	Moderate	1.54 higher likelihood of taking up transport-related cycling among women who moved to neighbourhoods with a higher population density.

- 1 This is the strongest type of evidence as it measures the impact of changes to the environment on walking and cycling and compares it to areas where there were no changes. Good, Moderate, Weak are reviewers’ assessment of the strength of this volume of evidence.
- 2 This type of evidence only shows that the aspect of the environment is related to levels of walking and cycling. This does not determine causality (for example, people who like walking may move to walkable neighbourhoods). Good, Moderate, Weak are reviewers’ assessment of the strength of this volume of evidence.
- 3 Good, Moderate, Weak are reviewers’ assessment of the extent to which this evidence can be applied to the UK, including the proportion of evidence that comes from UK studies.

Discussion

This review has been informed and shaped by 22 systematic reviews of hundreds of individual primary studies. As a ‘review of reviews’, it does not provide any new evidence, but does bring together a very wide range of different types of evidence to address the key research questions. This is a strong and consistent evidence base that allows us to make firm, evidence-based statements to address the primary research questions:

What role does the built environment play in encouraging or discouraging active travel for those aged 50-70?

There is good quality evidence from numerous systematic reviews that the environment plays a significant role in encouraging or discouraging active travel. This evidence comes from intervention studies and natural experiments that have seen increases in active travel when aspects of the built environment were improved. This review did not set out to quantify the specific impact of the environment compared to other aspects (such as behavioural interventions), but environmental interventions alone have been shown to lead to changes in levels of cycling and walking likely to have public health benefits. Combining environmental interventions with behaviour change approaches are likely to lead to even greater impacts.

As described in the introduction section, there is not a literature on the influence of the environment on the active travel behaviours of people aged 50-70. We conducted this review based on studies of adults of all ages based on the assumption that active environments that support active travel in adults of any age are highly likely to be applicable to this age group (apart from specific modes of travel such as travel to school). Following the review, we believe strongly that this assumption was correct: a significant part of the literature reviewed referred to people aged 65 or 70 and over and found positive impacts of aspects of the environment on their levels of walking or cycling. We have no reason to believe that the positive impact of the environment on active travel does not extend to people aged 50-70. However, the evidence would undoubtedly be strengthened by studies specifically addressing this age group.

What are the characteristics of the places where participation in active travel is high?

Places where active travel is high are likely to have the following attributes:

- Supportive infrastructure: a continuous route to travel along, whether on foot or by bicycle, with low perceived and real danger posed by motorised traffic or other risks and obstructions. For cycling, this will often require physical separation from traffic, especially in the form of new continuous and separate cycle routes. These will often require road space reallocation so that cycle infrastructure becomes a normal part of the traffic landscape rather than the exception.

- Walking and cycling-friendly connected street networks: environments that emphasise active travel and walkability. These ensure that active travel users are at minimal risk of injury when interacting with motorised traffic. This means ease of crossings, whether at junctions or along street sections which are made safer, making access to destinations easy.
- High density and mixed land uses: shops, housing and workplaces close together so that journey distances are short. Where there is high population density, services support local populations and people can interact without long journeys.

Beneath these global statements, these more detailed aspects of the environment also have an influence on active travel. These are presented as recommendations or implications for practice.

Implications of this review for policy and practice

- Build infrastructure that supports walking and cycling. This includes pavements, cycle lanes separated from motorised traffic, cycle parking, pedestrian/cyclist bridges and traffic-calming measures. Prioritise maintenance to ensure quality.
- Consider the different needs of pedestrians and cycle users and address them in urban design.
- Invest in cycling at the town level, making system-level changes rather than building piecemeal cycle lanes.
- Emphasise ‘walkability’. Invest in street networks that are connected and maximise accessibility to key local destinations.
- Emphasise safety – crossing roads with confidence requires better and more crossing facilities to increase connectivity, accessibility and convenience.
- Design and re-design neighbourhood street networks to enable short trips by bicycle as part of a programme to dovetail with ‘whole town/city’ networks.
- Ensure street network and connectivity components start from the doorstep - direct routes through neighbourhoods are critical for both pedestrians and cycle users.
- Increase accessibility and convenience within street networks so that they give pedestrians advantages over car use for short trips.

- Make town and village centres more attractive places to walk and cycle by aesthetic improvements such as seating, planters or small community parks.
- Take a longer-term view – disinvesting in towns and villages and encouraging out-of-town shopping and employment centres will increase car traffic and reduce active travel. An aim to increase population and housing density will help to ensure distances are short, supported by mixed land use so that local shops, services and facilities are viable.
- Below these headline recommendations, policymakers can use the guidance from the Department for Transport and walking and cycling groups on the specific, detailed aspects of micro-level environmental change to promote walking and cycling, for example detailed guidance on cycle lane design.
- Recognise that walking and cycling are allied with public transport. Every bus trip begins and ends with a walk. The availability and accessibility of public transport is reported as inducing walking (and to a lesser extent, cycling).
- Ensure ease of access to public transport through street networks designed with direct access to frequent stops and penetration of bus services into neighbourhoods that can increase both active travel and public transport use.

Comments on the review methods and findings

Methods

This evidence review concentrated on meta-analyses and systematic reviews with the most robust study designs in order to capture studies that had already been reviewed and graded by other researchers. This allows greater confidence in the findings than a review examining individual studies of weaker methodological design.

However, the disadvantage of this approach is a potential loss of detail, as within those reviews studies are amalgamated and focus on the main findings of each individual study. A new systematic review of primary studies would be possible, but this would require considerable additional resources. This review was also significantly complicated by the nature of the research questions, which necessitated a review of both intervention and correlates literatures which are rarely combined.

We also focused specifically on active travel in this review and did not include public transport use as an outcome. However, there is a strong link between the two modes and a more comprehensive review might also look into public transport.

Characteristics of this evidence base

Evaluating the impact of the built environment is challenging as it is not possible to conduct randomised controlled studies, and even quasi-experimental studies are rare. This has led to a preponderance of correlational studies that show a relationship between aspects of the environment and health or behavioural outcomes. It is also worth pointing out that many of these studies were conducted in North America, where the urban form is quite different to the UK. Many UK cities are highly walkable compared to ones in the USA, for example.

However, many researchers have taken note of developments happening to urban environments and used these to create well-designed ‘natural experiments’. These have helped to strengthen the evidence base. These should be the priority for future research.

Gaps

As stated above, there is a need for more intervention research, notably natural experiments. This would strengthen the case that active travel can be increased through environmental change. The ideal natural experiment would combine environmental change with a behaviour change element. In addition, studies that focus on ‘middle-age’ and ‘pre-retirement’ cohorts would be better placed to address questions specific to those age groups, rather than being combined with ‘older people’ age groupings, not least given the significant changes in active travel and in travel more generally when people retire.

Much of the literature focuses on urban areas, examining aspects of walking and cycling-friendly urban design. Little attention has been paid to the influence of the environment on walking and cycling in semi-urban or rural areas. It would also be interesting to see more research on the impact of measures taken to actively discourage car use, such as congestion charges, parking restrictions, road closures, fuel tax rises and road pricing. As is common with much transport research there is little in the evidence base on the differential impacts of the environment on specific population groups including minority ethnic communities and disabled people. Active travel includes wheelchair use, but we found no systematic reviews on this topic.

Implications for the qualitative research component of this project

As in the attitudes review, there is a paucity of evidence on active travel among 50-70 year olds and for minority ethnic adult populations and disabled people. Additional qualitative research in the 50-70 year cohort, including minority ethnic groups and people with disabilities, will address a gap in the research evidence. The review has shown that active travel is easier in urban areas (where journeys can be shorter as destinations closer). While it is likely that rural interviewees would not have much to say about active travel (because distances are too great between destinations and traffic danger is perceived as high), a range of geographic settings will be considered in the primary research.

Conclusion

Regular physical activity is key to a healthy lifestyle. Walking and cycling for transport have been identified as among the easiest ways to build routine physical activity into daily life, yet levels of active travel in England are low and declining.

This review has shown that the built environment plays a significant role in encouraging or discouraging active travel and the evidence amassed is highly likely to be applicable to those aged 50-70. It has shown that active travel can be increased through changing the environment and optimising the features of towns and cities that make it easier to walk and cycle.

By investing in supportive infrastructure, developing walking and cycling-friendly connected street networks and prioritising high-density urban centres with mixed land uses, we can help to 'make the healthy choice the easy choice'.

To date, recommendations guided by robust evidence, such as those from NICE and the What Works Centres, among others, have largely been overlooked by decision makers of road transport interventions. This is likely to be significantly related to normative attitudes and behaviour around designing for car use above other modes established over half a century together with economic and political forces that support the hegemony of car culture.

Implementing recommendations for significant changes to the functioning of road transport will remain a major challenge. It is hoped that this review will add to the evidence base to support advocacy for such changes.

Appendix B. Details of included studies

Author	Publication date	Title	Study type
Panter	2019	Can changing the physical environment promote walking and cycling? A systematic review of what works and how	Systematic review
Stappers	2018	The effect of infrastructural changes in the built environment on physical activity, active transportation and sedentary behavior – A systematic review	Systematic review
Stewart	2015	What interventions increase commuter cycling? A systematic review	Systematic review
Ding Ding	2018	Moving to an active lifestyle? A systematic review of the effects of residential relocation on walking, physical activity and travel behaviour	Systematic review
Foster	2018	What works to promote walking at the population level? A systematic review	Systematic Review
Kärmeniemi	2018	The Built Environment as a Determinant of Physical Activity: A Systematic Review of Longitudinal Studies and Natural Experiments	Systematic Review
Molenberg	2019	A systematic review of the effect of infrastructural interventions to promote cycling: strengthening causal inference from observational data	Systematic review
Smith	2017	Systematic literature review of built environment effects on physical activity and active transport – an update and new findings on health equity	Systematic review
Cerin	2017	The neighbourhood physical environment and active travel in older adults: a systematic review and meta-analysis	Systematic review; Meta-analysis
Barnett	2017	Built environmental correlates of older adults' total physical activity and walking: a systematic review and meta-analysis	Systematic review; Meta-analysis
Ewing	2010	Travel and the Built Environment	Meta-analysis
Hilland	2020	Correlates of walking among disadvantaged groups: A systematic review	Systematic Review
Lin	2020	Workplace neighbourhood built environment and workers' physically-active and sedentary behaviour: a systematic review of observational studies	Systematic review

AT active travel **PA** physical activity **RCT** randomised controlled trial

Types of studies included	Main outcomes	Number of studies included that reported an Active travel [AT] outcome
Interventions	Walking and cycling	13, most focus on transport walking and cycling
Quasi-experimental; Natural experiments	AT and PA	19 studies included, most of which are AT
RCTs (2) Pre-post (10)	Commmuter cycling	12 (but many of these not environmental interventions)
15 longitudinal prospective studies; 8 retrospective longitudinal/ quasi-longitudinal studies	PA, walking, cycling or travel modal change	23 quantitative studies
Pre-experimental and post-experimental studies. Natural experiments that combined three approaches—mass media, community initiatives and environmental change	Increased walking	Of 12 studies, eight with minute-per-week walking to estimate the magnitude of effects across a mix of population-based approaches
longitudinal before-and-after design: 21 prospective cohort studies and 30 natural experiments with at least 2 data collection points	PA: Assess changes in built environment and PA	In 16 natural experiments, a change in infrastructure was associated with increased physical activity in nine studies and decreased physical activity in one study. Majority of these studies assessed new routes for walking and cycling
Interventions	Cycling only	31 - but all sorts of cycling - mainly functional/ daily
Controlled repeat cross-section (8) Uncontrolled longitudinal (12)	AT and PA	13 studies looked at AT, the remainder general PA
Cross-sectional studies. 21 were represented by a single article, while the remaining 6 studies had 2 to 6 articles	AT outcomes (total walking for transport, within-neighbourhood walking for transport, combined walking and cycling for transport, cycling for transport, and all AT outcomes combined)	42 quantitative studies
“Quantitative study; Study with a cross-sectional, longitudinal or quasi-experimental design	Total PA and walking	55 of walking; nine of these with objective PA
Correlational studies	Walking and transit use	50
Observational studies (cross sectional or longitudinal); Quantitative studies that included a p-value to indicate significant association	Studies also had to examine overall walking, leisure-time walking or walking for transport	9 examined walking for transport
Observational	PA and sedentary behaviours	55 studies in total of which 44 measured transport walking

Appendix B. Details of included studies

Author	Publication date	Title	Study type
Yun	2019	Environmental Factors Associated with Older Adult's Walking Behaviors: A Systematic Review of Quantitative Studies	Systematic review
Farkas	2019	A systematized literature review on the associations between neighbourhood built characteristics and walking among Canadian adults	Systematic Review
Grasser	2013	Objectively measured walkability and active transport and weight-related outcomes in adults: a systematic review	Systematic Review
Durand	2010	A systematic review of built environment factors related to physical activity and obesity risk: implications for smart growth urban planning	Systematic review
Fraser	2010	Cycling for transport and public health: a systematic review of the effect of the environment on cycling	Systematic review
Van Holle	2012	Relationship between the physical environment and different domains of physical activity in European adults: a systematic review	Systematic review
McCormack	2011	In search of causality: a systematic review of the relationship between the built environment and physical activity among adults	Systematic review
Rosso	2011	The Urban Built Environment and Mobility in Older Adults: A Comprehensive Review	Systematic review
Van Cauwenberg	2011	Relationship between the physical environment and physical activity in older adults: A systematic review	Systematic review

AT active travel **PA** physical activity **RCT** randomised controlled trial

Types of studies included	Main outcomes	Number of studies included that reported an Active travel [AT] outcome
Cross-sectional (67) Longitudinal (3)	PA and AT	70 studies total; 14 studies transport walking
All but two studies were cross-sectional. All quantitative.	Overall walkability. AT: most studies captured self-reported walking for transportation and walking for any purpose	14 as walking for transport
Quantitative studies; 33 of 34 with cross-sectional design	Walking and cycling for transport, or overall active transportation (combining walking and cycling for transport or active transport) or weight-related measures	34 studies: most used weight-related measures as an outcome; a minority used PA.
Mixed	PA and obesity risk	44
Experimental or observational studies	Primary outcome of cycling prevalence (numbers or rates of people cycling, including active commuting or leisure cycling)	11 studies identified an objectively measured environmental factor associated with higher rates of cycling that was statistically significant
Cross sectional (69); Longitudinal (1)	PA and AT	AT 6; transport walking 11; transport cycling 19
Quasi-experimental (13); Cross-sectional (20)	Transport walking; general cycling (?)	8 walking for transport; 6 general cycling
Longitudinal (4); Cross-sectional (13)	Walking	12 ?
Prospective (3); Cross-sectional (28)	PA	6 transport walking

Appendix C. Included studies by key themes

Author (year)		Kärmeniemi et al (2018)	Panter et al, 2019	Stappers et al, 2018	Stewart et al, (2015)	Ding Ding et al (2018)	Foster et al (2018)	Molenberg et al (2019)	Smith et al (2017)
Key Themes	Infrastructure for walk/cycle	WC		C	C		W	C	C
	Street Network Characteristics/Connectivity*	W	WC			WC		WC	WC
	Traffic and personal safety		WC		C	WC			W
	Accessibility	W	WC			WC			
	Density	WC	WC						WC
	Town/city wide			C	C			C	
	Land use mix	W		C					WC
	Aesthetics	W				W			
	Temporary road closures								WC
	Convenience	W							

Systematic reviews of intervention studies

Meta-analyses of cross-sectional studies

Reviews of cross-sectional studies/observational studies

W Walking
C Cycling

Cerin, et al, (2017)													
Barnett et al (2017)	W									C	C	C	
Ewing, Cervero, (2010)	W	W			W	W	WC			C	WC	WC	W
Hilland et al (2020)			W		W	W							W
Lin et al (2020)						W				C	WC		
Yun et al (2019)						W	WC	W		C		WC	W
Farkas et al (2019)						W	WC	W		C		WC	W
Grasser et al (2013)						W	WC	W		C		WC	W
Durand et al (2010)						W	WC	W		C		WC	W
Fraser, Lock (2010)						W	WC	W		C		WC	W
Van Holle et al (2012)						W	WC	W		C		WC	W
McCormack, Shiell (2011)						W	WC	W		C		WC	W
Rosso et al (2011)						W	WC	W		C		WC	W
Van Cauwenberg et al (2011)						W	WC	W		C		WC	W
					WC								W

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